The Electrical Industry's Weekly Magazine September 19, 1960

Electrical World

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11th annual electrical industry

1960 1980

FORECAST

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WHAT CAN BE DONE IN THE EQUIPMENT MARKET?

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UMI MICROFILMS INC
EDITORIAL DEPT
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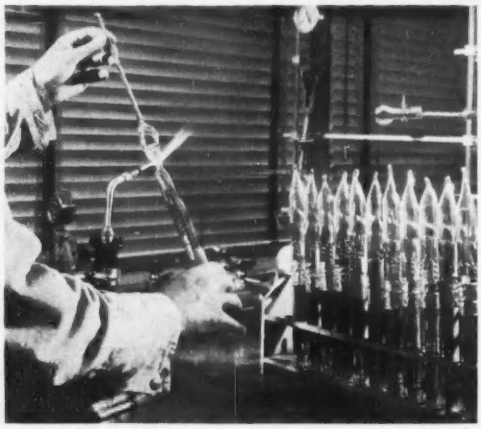
General Electric's Permalex* Insulation Takes the Steam Out of an Old Problem in Transformer Design



ACCELERATED AGING of scaled-down hermetically sealed insulation systems (above) in ovens (below) gives scientists in G.E.'s Insulation Lab important data on thermal resistance and compatibility of materials.

GENERAL ELECTRIC'S PERMALEX INSULATION SYSTEM is one of the most significant developments in the last 25 years. Quite literally, it takes the steam out of the old problem of thermal degradation of insulation systems in distribution, network, and medium transformers.

WATER, formed under higher operating temperatures, causes deterioration of all insulation components. The weakest link, therefore, until the development of Permalex insulation, was kraft paper, whose cellulose structure includes water-forming hydroxyl groups.

TO MARKEDLY REDUCE WATER FORMATION, scientists in General Electric's Insulation Materials Laboratory, after evaluating many alternatives, hit upon cyanoethylation of paper pulp as the best solution. In this process, cyanoethyl groups replace the most weakly held hydroxyl groups on the cellulose molecule, altering its chemical structure. Hydroxyl groups which are not replaced have their chemical bonds strengthened.

BENEFITS of this important development are either greater transformer loadability or longer transformer life. This is true because:

- Thermal resistance of kraft paper insulation is increased at least 20% in the range of 150 to 175C.
- The dielectric life of even the best enameled wire, such as Formex* wire, is also increased.
- The life of the transformer oil is increased.
- Cyanoethylation is a *chemical* reaction with the kraft pulp; it is not an additive or scavenging process with materials that can be dissolved out to contaminate the oil or induce corrosion of metal.
- Cyanoethylated kraft paper is completely compatible with all other materials used in General Electric transformers.

A 20 PERCENT THERMAL uprating of distribution transformers originally announced by General Electric scientists in 1959 now appears to be quite conservative after a year's experience with Permalex insulation. The direct and quantitative relation of thermal improvements to higher transformer loadability is of great fundamental importance to the industry and may well foreshadow a revision of industry standards. Meanwhile, you may profitably utilize the higher kva 55°/65° ratings appearing on all General Electric oil-filled distribution, medium, and network transformers.

SAVINGS that you can realize with General Electric distribution, network, and medium transformers can be spelled out for you by your General Electric Sales Engineer. Call him today. General Electric Company, Schenectady 5, N. Y.

604-07

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GENERAL ELECTRIC

Electrical World

Vol. 154, No. 12 SEPTEMBER 19, 1960

Published for 86 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

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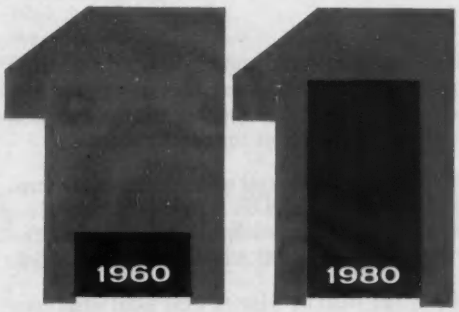

th annual electrical industry FORECAST

Using improved statistical techniques to survey the dynamic electric utility industry's myriad aspects through the next 20 years, this 16-page report begins on page 103.

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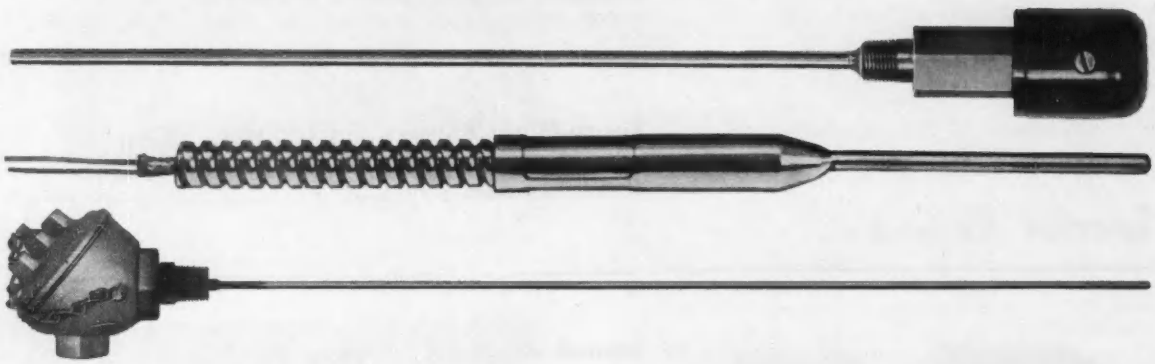
CHOOSE FROM 150,000 STANDARD *MegopaK* SMALL-DIAMETER THERMOCOUPLES



If you've been looking for small-diameter, flexible thermocouples with high speed of response, search no more. You'll find exactly what you need in Honeywell's *MegopaK** line.

MegopaK is a combination of thermocouple wires, mineral insulation and a protecting sheath, compacted into a solid mass with a diameter as small as 1/16". You can get *MegopaK* in standard lengths up to 25 feet, and in lengths up to 50 feet on special order. They're available with copper-constantan, iron-constantan and *Chromel-Alumel*** calibration. In all, there are more than 150,000 standard combinations of materials and fittings. These top-quality thermocouples are supplied in bulk, and as elements with wires welded into a measuring junction, or as complete assemblies.

MegopaK assemblies come complete with terminations (heads, plugs, etc.) and mounting attachments. Also available are special configurations, tests, material and calibration certifications.

MegopaK thermocouples and other pyrometer supplies are stocked at our Los Angeles and Dallas depots as well as in Philadelphia to give you the fastest possible service anywhere in the country.

Check with your nearby Honeywell field engineer for complete details, or write for Catalog G100-4.

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LETTERS

More Power to International Conferences

To the Editor:

. . . The editorial comment (EW, July 25, p 39) with respect to the small attendance at these (World Power Conference and CIGRE) meetings by representatives of the electric power industry in the United States . . . appears to me . . . both timely and to the point.

Registration from the United States at the Madrid (WPC) meeting included 14 from federal government agencies, seven from TVA, and 12 from the electric power industry. While this is a fairly good attendance from organizations directly or indirectly concerned with electric power, the participation by US representatives in technical sessions of the conference left much to be desired. Something should be done about this problem if the power industry of the United States is going to maintain its stature in the eyes of the power people of other nations of the world. Your editorial is a helpful step towards this objective.

I am planning to call a meeting of the Executive Board of the WPC National Committee in September at which this problem, among others, will be discussed. I have hopes that we will be able to find some means of stimulating greater participation by the power industry in the next meeting of the World Power Conference in Melbourne, Australia, in October, 1962. Undoubtedly, there will be various ways in which *Electrical World* could assist the national committee in publicizing the plans for this meeting and I am sure the committee will greatly appreciate your assistance.

Francis L. Adams
Chief, Bureau of Power
Federal Power Commission
Washington, D. C.

▶ *We will, of course, be most happy to give this effort our wholehearted support.*

Too Tall an Insulator

To the Editor:

Now, now! I know the Lapp Insulator Co is a fine organization but I don't believe the insulator mentioned in the article on page 76 of the August 29 issue is really 112 ft long.

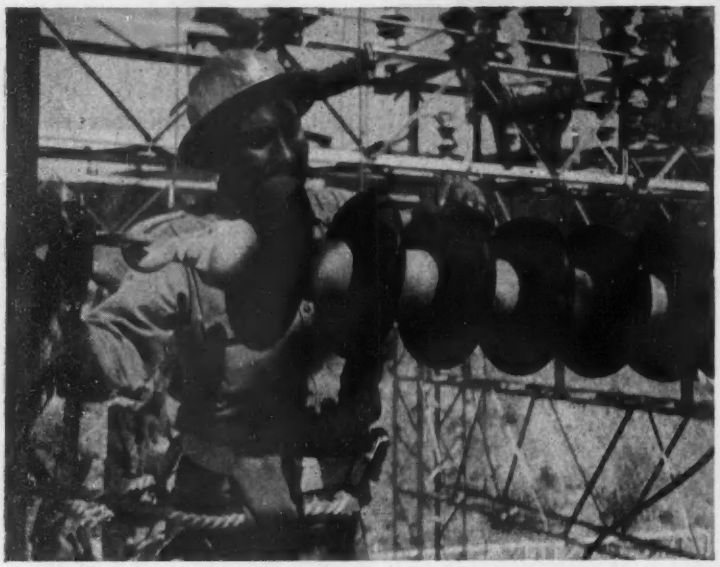
Do you?

Clarence H. LeVee, vp-engineering
A. B. Chance Co
Centralia, Mo.

▶ *Reader LeVee is right. EW erred. Length of the insulator is* 112 *in.—not* 112 *ft. The error led another reader to comment that the man pictured beside the giant insulator "has certainly grown during the past year."*

SILICONE NEWS from Dow Corning

"Wipe Away" Maintenance

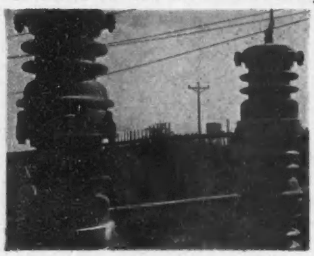


Coating of Silicone Compound Cuts Outages and Cleaning Costs

Preventing conductive leakage paths on power insulators in heavily contaminated areas is greatly simplified by an easy-to-apply coating of Dow Corning silicone compound.

Reduced maintenance plus fewer, shorter outages make substantial savings possible. One Midwest utility, with a 35.5-kv line and substation located near a cement plant, was forced to dissassemble its insulators 3 times a year for thorough scrubbings with solvents and steel wool. Now, after coating these insulators with silicone compound, contamination is simply wiped off with dry rags every six months and a new silicone coating applied . . . at a fraction of the cost and outage time formerly involved!

Another company reports silicone compound has reduced its cleaning schedule on 138-kv insulators by 75%. Other utilities from coast to coast report similar savings . . . have found Dow Corning silicone compound effective against such airborne contaminants as: cement dust; detergents; carbon black; salt accumulation from sea water; fertilizer and alkali dust; fly ash; general industrial dust; metallic ores such as taconite, aluminum and lead ores, chemicals such as sulfuric acid, calcium chloride and soda ash.



Dust from stacks of cement plant, visible in the distance, posed a severe flash-over problem before insulators were silicone coated.

Silicone compound is easily applied with a rag or stiff brush . . . solvent dispersions can be brushed or sprayed on.

Prevent Arcing, Flashover Damage. Dow Corning silicone compound is highly repellent to water or moisture, will not melt in hot weather or turn stiff in cold weather, and has excellent electrical resistance. Photo-micrographs reveal the silicone compound completely surrounds dust, dirt and other contaminants to prevent them from absorbing water and becoming conductive. The photo illustrates how moisture "beads" on the silicone coated surface and rolls off harmlessly without forming conductive moisture paths. The protection is effective so long as moisture "beads".

Cleaning Greatly Simplified. Even the most tenacious contaminants can be easily wiped off treated insulators and a new silicone coating applied in a matter of minutes. It's unnecessary to remove insulators from their mounts, to use solvents, steel wool, wire brushes or set up elaborate cleaning procedures.

For complete information on how you can reduce insulator maintenance and avoid frequent, prolonged outages with a Dow Corning Silicone Compound, write Dept. 3109

Your nearest Dow Corning office is the number one source for information and technical service on silicones.

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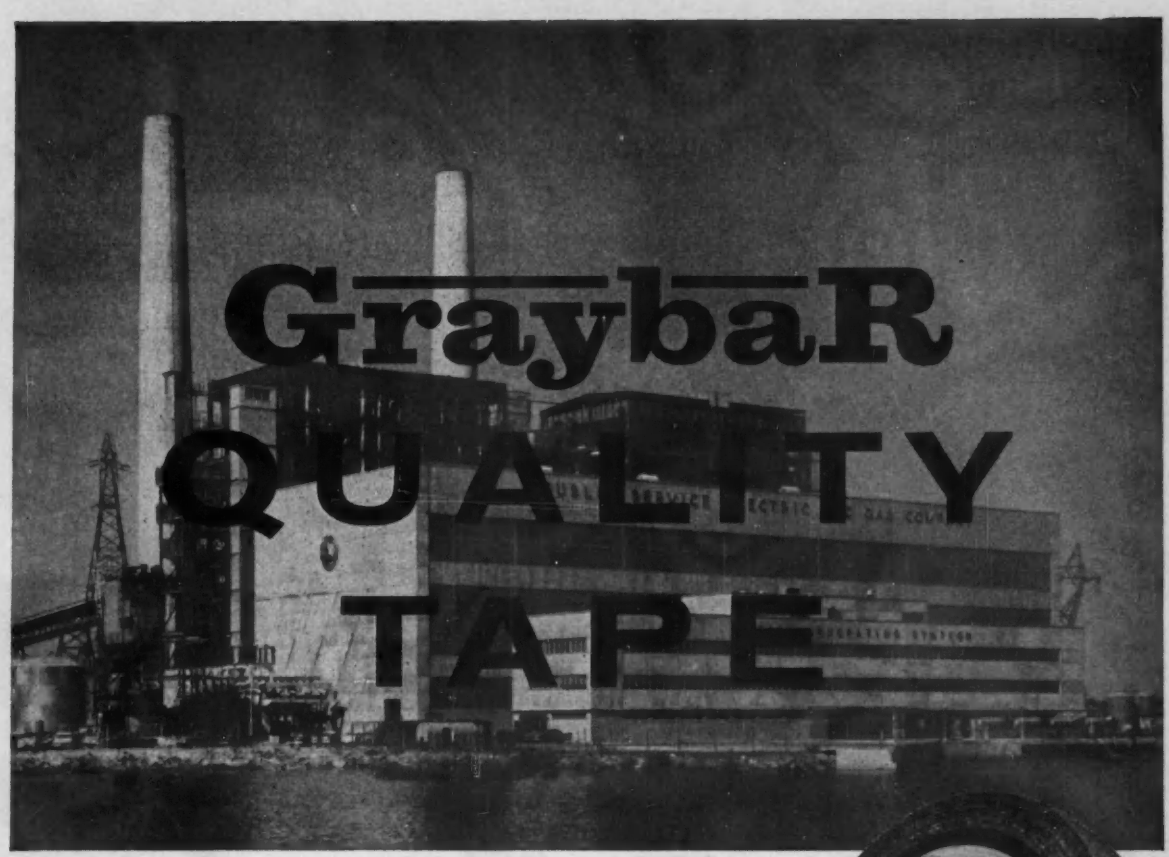

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This is the second Universal Pressure Boiler to go on the line . . . and there are more on the way. As at the Breed Plant, products of Babcock & Wilcox engineering and research will help utilities and industry to meet the challenging growth of the future . . . The Babcock & Wilcox Company, Boiler Division, Barberton, O.

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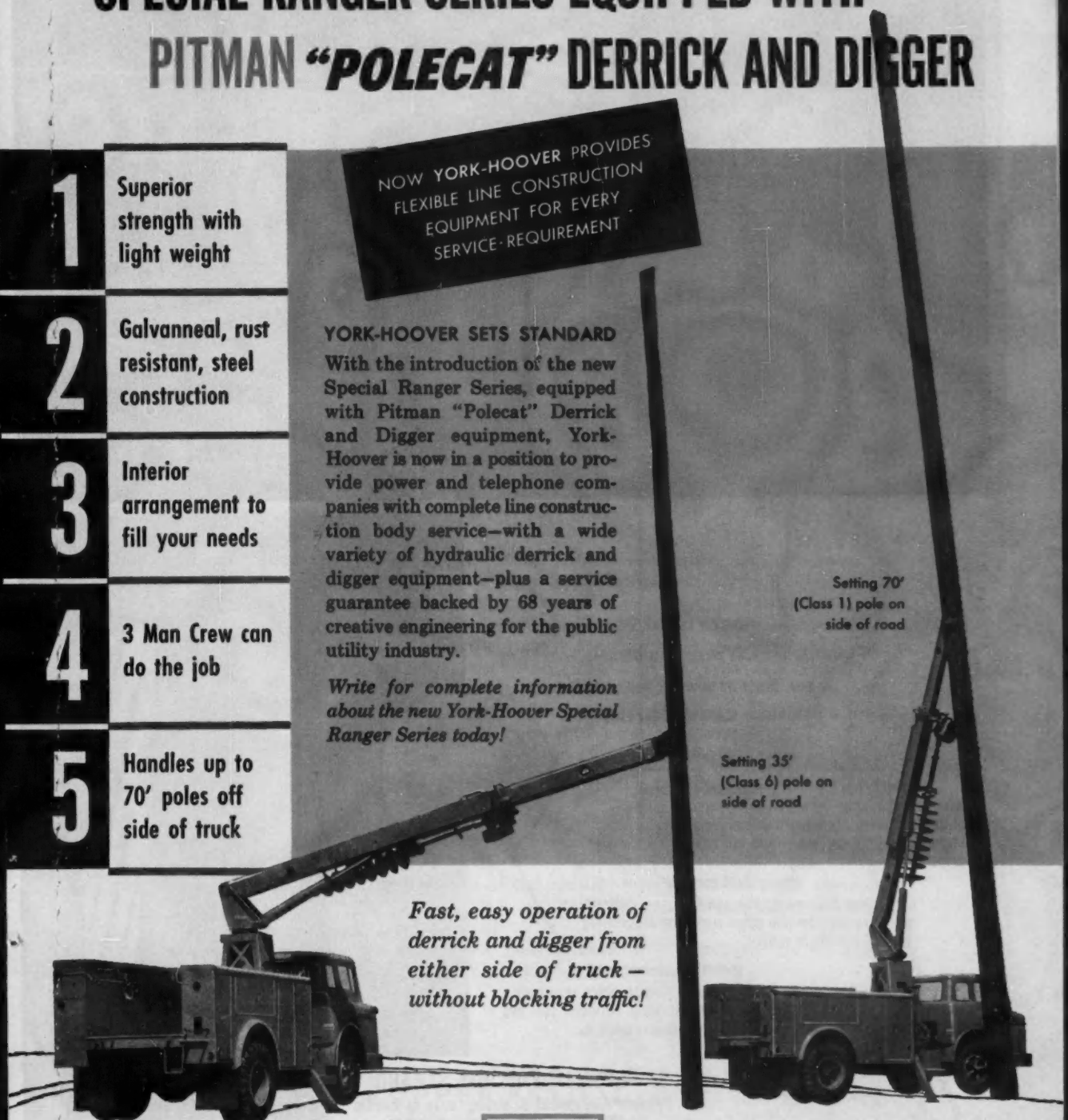

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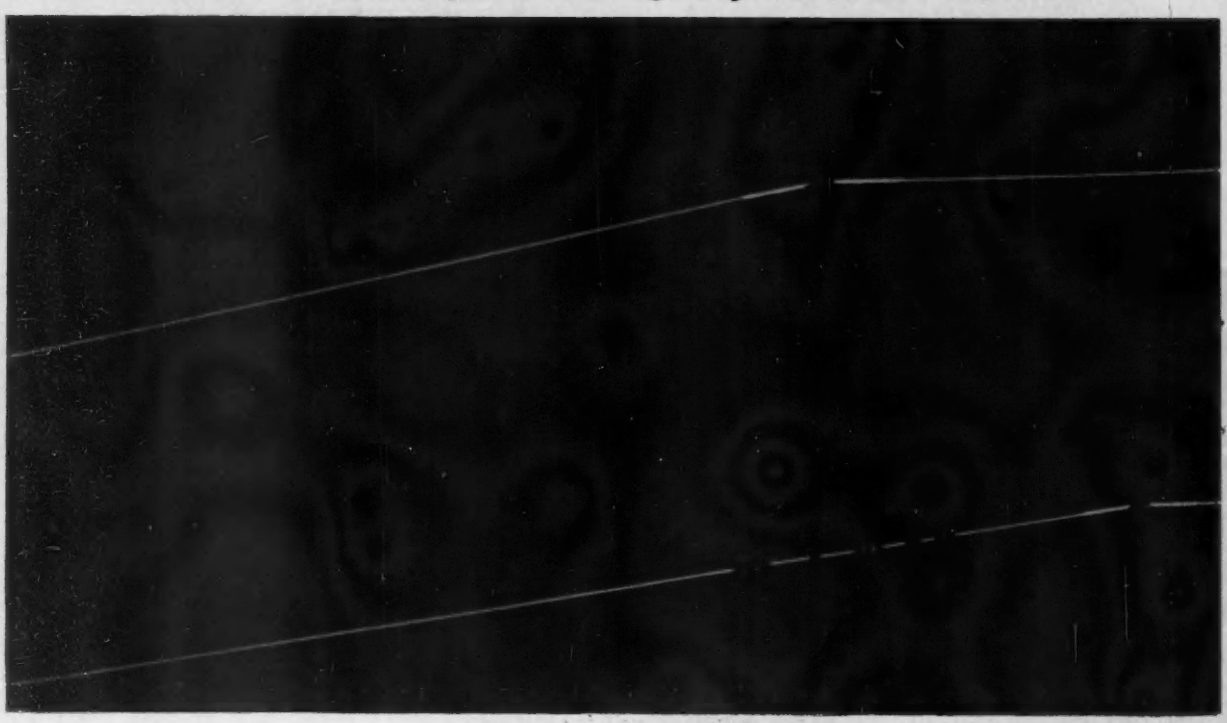

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IS THE MOST EFFECTIVE SHIELDING

FOR YOUR TRANSMISSION LINES

thick aluminum covering

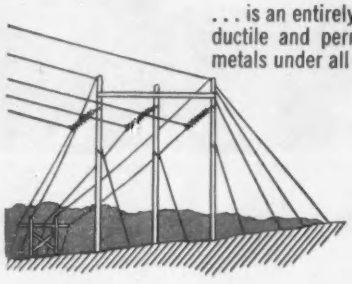
. . . provides 3 times the conductance of steel wire and the same corrosion resistance as solid aluminum wire. Alumoweld's heavy cladding of aluminum—25% by area—will not crack, flake or peel.

strong steel core

. . . gives Alumoweld the same rugged strength as extra-high-tensile steel wire, yet Alumoweld is 18% lighter in weight.

controlled atomic weld

. . . is an entirely new process which results in a ductile and permanent weld between the two metals under all operating conditions.



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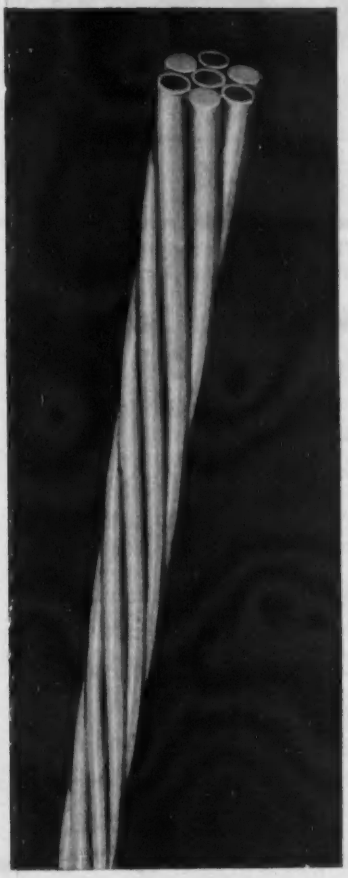
overhead ground wire



Alumoweld Overhead Ground Wire is in a class by itself! In addition to its superior mechanical and electrical properties, this new aluminum-covered steel wire offers the money-saving benefits of low original cost and lowest maintenance cost.

Having the rugged strength of extra-high-tensile steel wire, Alumoweld is 18% lighter in weight . . . has three times the conductance . . . and will last far longer. When compared to solid aluminum wire, Alumoweld has equal life, one third the conductivity, and eight times the strength.

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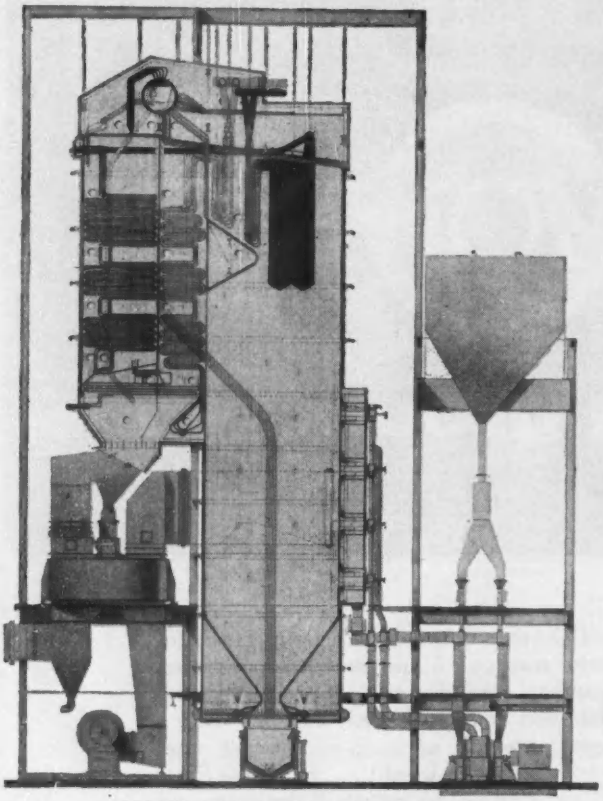

950,000 lbs./hr., 1950 psig, 1000/1000F;
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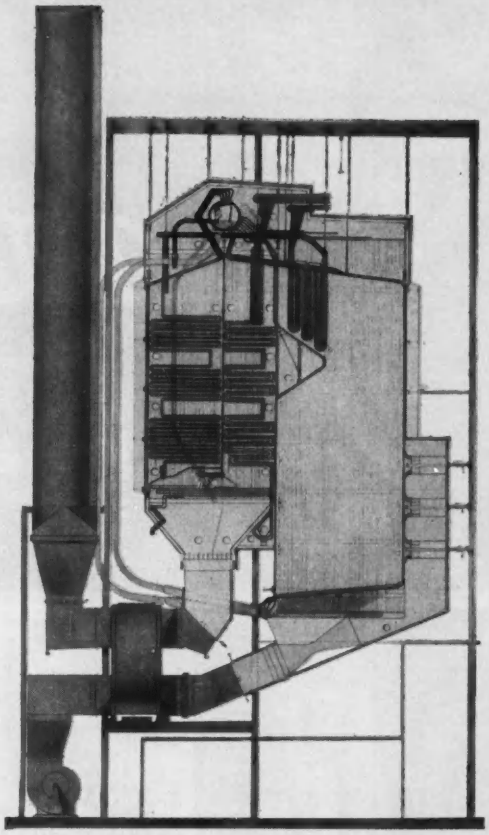

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Monongahela Power Company
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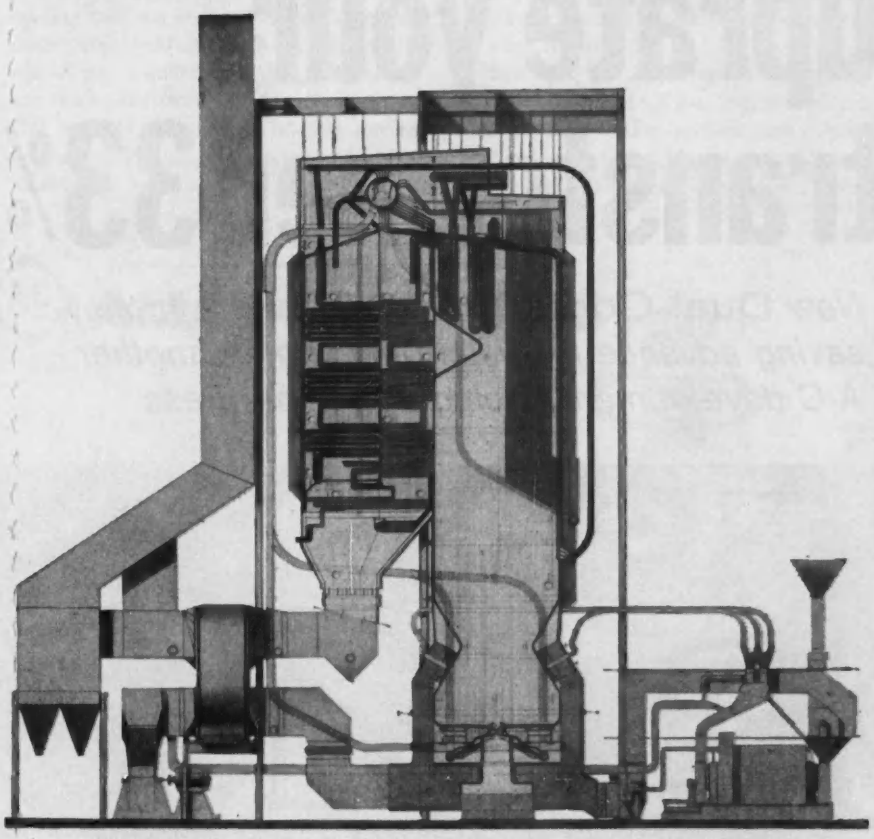
Union Electric Co. of Mo. (7)
Pennsylvania Electric Co.
Iowa Electric Light & Power Co. (3)
Iowa-Illinois Gas & Electric Co. (7)
Montana-Dakota Utilities Co.
Mississippi Power Company
Philadelphia Electric Co. (4)
Central Ohio Light & Power Co. (6)
Gulf Power Co. (4)
Otter Tail Power Co. (5)
Public Service Elec. & Gas (N.J.) (7)
So. Carolina Elec. & Gas Co. (3)
Taiwan Power Company (2)

Numbers Indicate Repeat Orders



1,600,000 lbs./hr., 2125 psig, 1005/1005F; Turbo Furnace with Riley Ball Mills; Pressurized Furnace. Fuels — Gas, Oil, Coal

Techniques, Selectivity Of Fuel Burning Equipment Nature of Fuel, Load, and Steam Conditions

Riley Provides Skilled Construction Engineering Services

Riley Stoker Corporation supplies complete construction services. Riley construction crews employ the latest in construction methods and techniques.

Experienced Service Engineers Assist In Maintaining Safe, Efficient Operation Of Your Boiler

Riley Service Engineers are trained for prompt and efficient servicing of all Riley installations. These experienced engineers work closely with your operators.

Riley Stoker Corporation, having successfully met the challenge imposed by the remarkable growth of the public utilities in the past decade is thoroughly prepared to meet the even greater challenges to come.

Charlotte, Chicago, Cincinnati, Cleveland, Detroit, Houston, Jacksonville, Kansas City, Los Angeles, New Orleans, New York, Philadelphia, Pittsburgh, Portland, Salt Lake City, San Francisco, Seattle, St. Louis, St. Paul, Syracuse, Worcester.

RILEY STOKER CORPORATION, WORCESTER, MASS.

RILEY

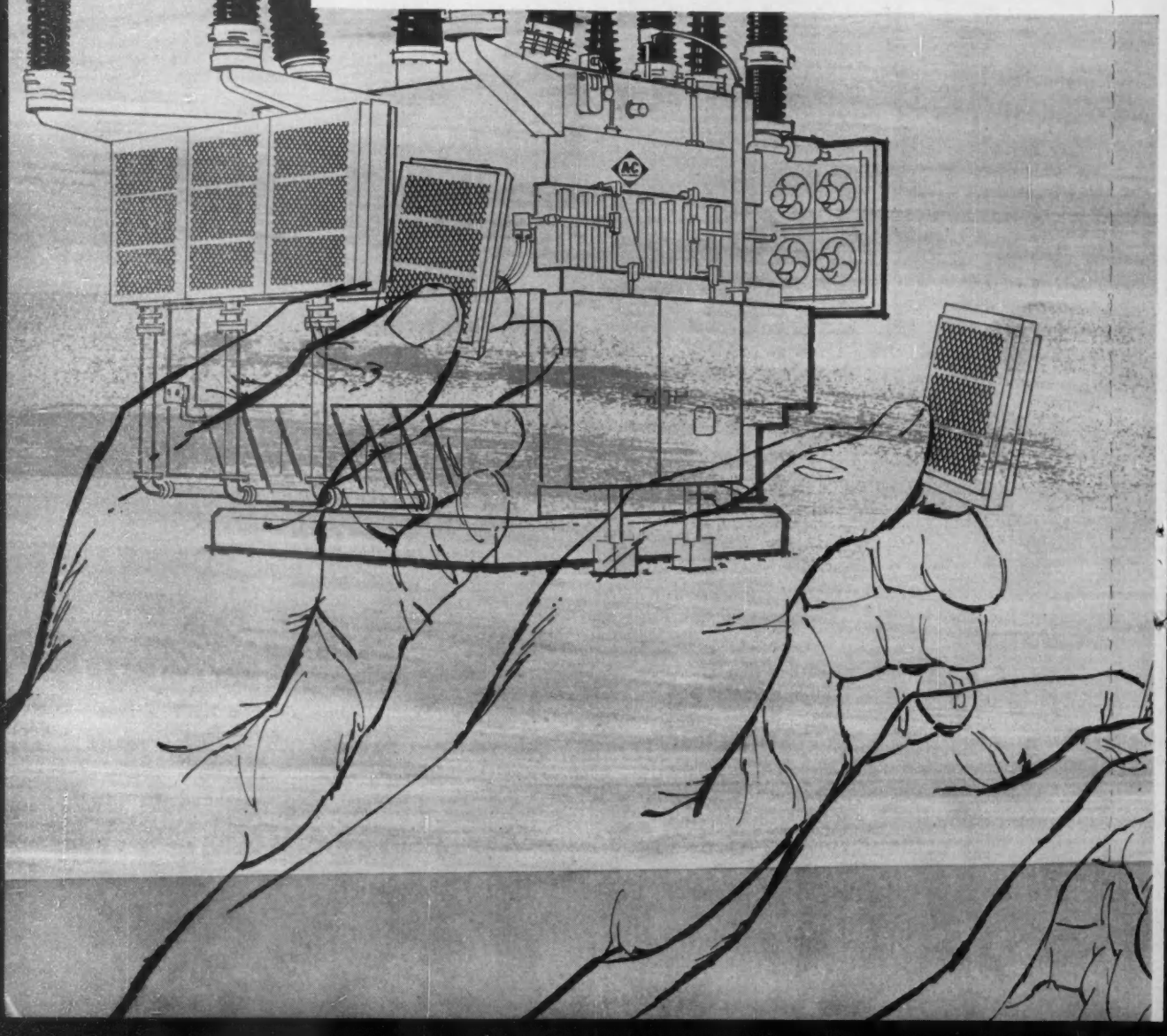
STEAM GENERATING & FUEL BURNING EQUIPMENT

Surprising Savings In Your Power Costs

During emergencies, exclusive Allis-Chalmers development will

uprate your transformer 33%

New **Dual-Cooled** *transformers are money-saving advance in system planning... another A-C development pacing power progress*



Pictured here is a *Dual-Cooled* power transformer — the first of two required for Wisconsin Electric Power Company's Blue Mound Station. It's proof that you can now buy *smaller* transformers instead of paying for largely unused standby capacity.

WEPCO takes advantage of both dual-cooling and low ambient temperatures to carry projected peak loads during an outage of one transformer. This means they can buy minimum size transformers — 290 mva — all that is needed during normal operating conditions throughout most of the year.

However, during an outage of one unit, 460-mva can be carried by a second transformer at 32 F ambient air temperature. This 460-mva rating (somewhat less at higher ambient air temperatures) is achieved by adding *Electro-Coolers* from the idle transformer. Exchange is made practical *and* without service interruption by use of manual shutoff valves located in each cooler pipe.

You can get Dual-Cooled *transformers in any rating from 20,000 kva up. For full information, contact your nearby A-C office or write* **Allis-Chalmers,** *Power Equipment Division, Milwaukee 1, Wis.*

A-1286

Dual-Cooled and Electro-Cooler are Allis-Chalmers trademarks.

ALLIS-CHALMERS

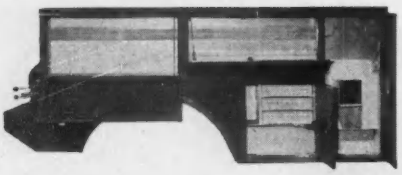
Holan "Space Vehicle" Hits the Road with Two-Day Payload

There's nothing "blue sky" about the space demands of a utility crew. To do the job — big or little — it takes a body engineered to squeeze the last ounce of payload from cab to overhang.

Holan's 5102-S Body does just that. In fact, this two-man work unit sports such functionally-designed compartments and so much room that a two-day supply of equipment can be carried without overloading.

Add to that the Model 25-C Derrick which can handle 8,500-pound loads and 60-foot poles and you have one of the industry's most economical, most efficient units. The work unit is mounted on a chassis with 72" CA and dual rear tires and has such a short body overhang that derrick load limits are appreciably increased before jacks are required.

Plenty of space . . . plenty of strength . . . and splendid for telephone, municipal, power company rural work and R.E.A. field assignments. Write today — or get in touch with your Holan Field Representative for complete details.



Holan Corporation, 4100 West 150th Street, Cleveland 35, Ohio
Plants in: Cleveland, Ohio; Griffin, Georgia; Phoenix, Arizona

Holan

Subsidiary of THE OHIO BRASS COMPANY

HOLAN

WESTINGHOUSE POWERCASTING* initiates 3 broad EHV transmission programs

predicts conquest of major problems blocking economical use of high voltage

Extends massive investigations of the last 13 years . . . helps utilities hold investment costs down

How to invest 30 billion dollars? POWERCASTING can help

Over the next 20 years, the electric utility industry will make a transmission system investment of 30 billion dollars. Much of it will be in extra-high voltage . . . because it will be technically and economically necessary to do so.

To invest on this scale in EHV systems will require a high order of long-range planning—to anticipate the right problem, make the right decisions, at the right time.

Westinghouse POWERCASTING is available to you today to do this planning-ahead job . . . to do it thoroughly and with scientific accuracy. POWERCASTING, through broad system investigations and problem solving, can help you plan your transmission system expansion . . . economically, and now.

POWERCASTING continues to search problems for solutions . . . to accelerate Westinghouse lead in EHV research

Westinghouse is currently attacking three primary problem areas:

1. Radio influence and corona loss.
2. Lightning flashovers.
3. Switching surges.

Important new programs are underway in these areas.

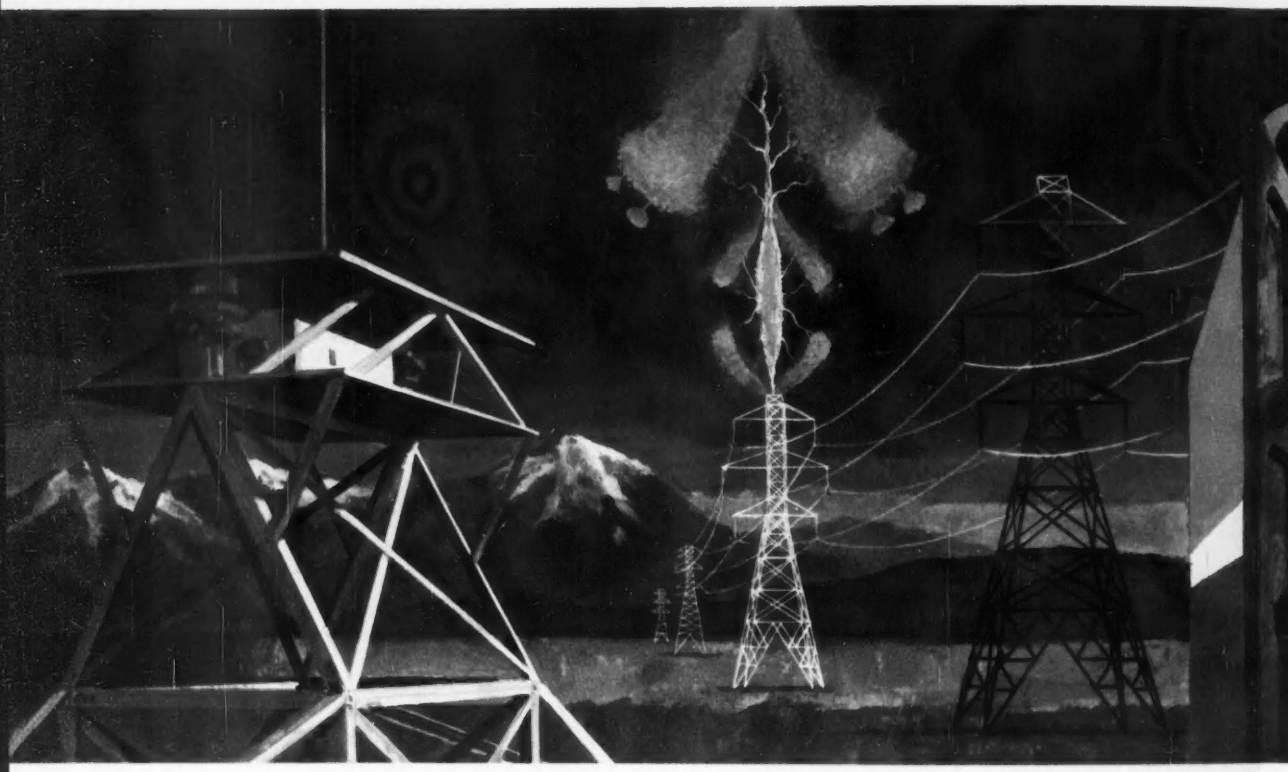
EHV research is not a new area for Westinghouse. The current programs are based on broad investigations that began as far back as 1947. The Tidd project, begun in that year with the American Electric Power Company, proved that transmission voltages up to 520 kv could be reliable and practical.

*A Service-Mark of Westinghouse

YOU CAN BE SURE...IF IT'S **Westinghouse**

WESTINGHOUSE POWERCASTING*

joins with high-voltage studies to



The Leadville tests, begun in '56 with the Public Service Company of Colorado, are providing valuable data on performance of EHV lines at high altitudes.

These studies provided much of the technology for building today's EHV lines.

1. New Westinghouse test line probes secrets of radio influence and corona loss at higher voltages

A third intensive Westinghouse study of R.I. and corona is now underway.

At Trafford, Pennsylvania, Westinghouse is building a special line to study fundamentals of corona formation, generation and control of R.I. and the development of new measurement techniques. The knowledge gained from this test line will be applied in a new large-scale test program.

These studies will permit the design of EHV lines above 500 kv when POWERCASTING indicates their need.

2. The lightning surge problem...Westinghouse Prestrike Theory

From intensive studies of the lightning stroke mechanism, Westinghouse has evolved the new and revolutionary Prestrike Theory. According to this theory, the tip of the lightning leader contains a large charge which is rapidly injected into the transmission tower. The result is a high-magnitude, short-duration current —prestrike current—producing very high voltages across the insulator string. The prestrike current will account for the higher-than-predicted outages on certain designs of EHV lines.

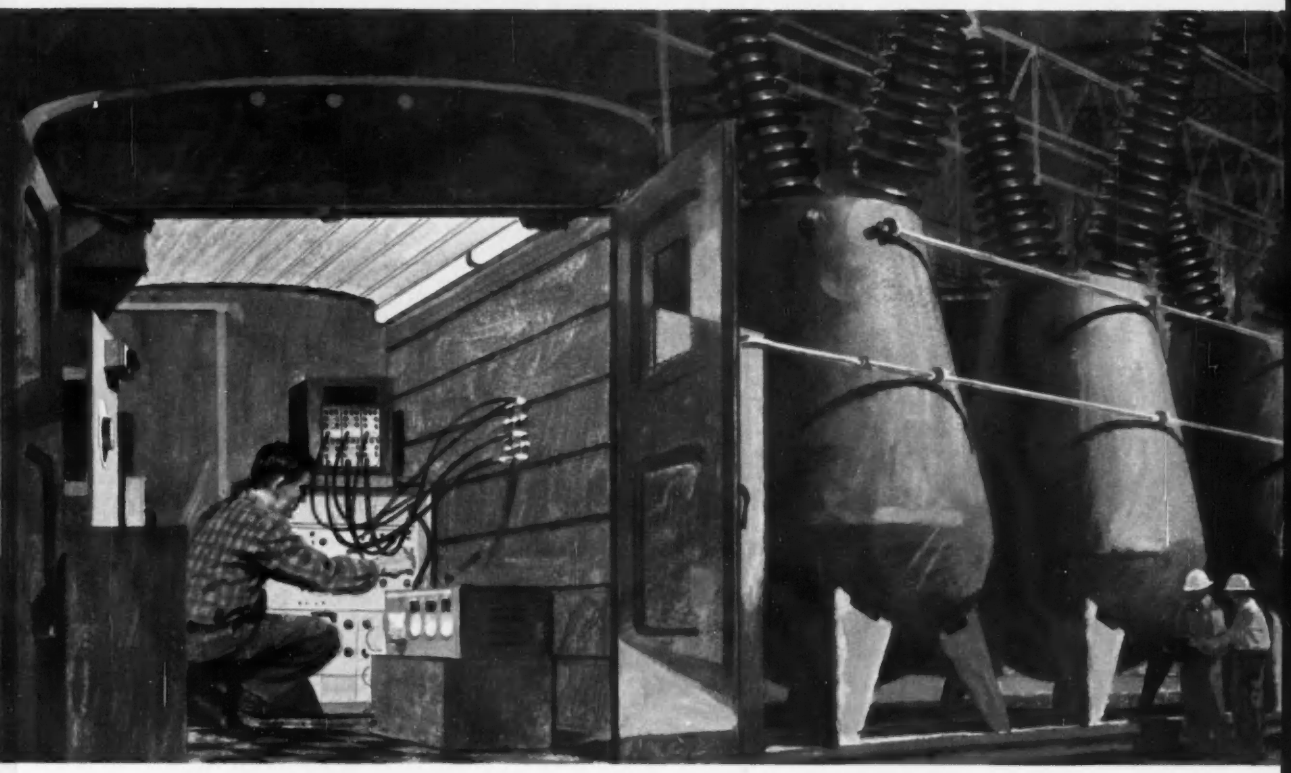
To determine the existence of the prestrike . . .

Westinghouse developed unique current-time measuring instrument, the Kine-Klydonograph

The KINE-KLYDONOGRAPH is one of the many unique instruments developed by Westinghouse to probe the secrets of lightning. It is capable of accurate measurement of the current wave shape of a natural lightning stroke over a wide time range—0.05 to 15 microseconds. The records from these instruments will verify if the prestrike does exist.

The Kine-Klydonograph is mounted atop the transmission tower. Since June of 1959, 20 such instruments

facilitate economic growth of EHV lines



have been installed on a 345-kv line, and an additional 60 instruments are being installed this year.

Westinghouse is currently focusing attention on these critical characteristics of lightning. These investigations will lead to more realistic line and equipment design and to more reliable EHV transmission.

3. Westinghouse—AEP, in two-year field test program, to make extensive study of switching surge problem

Early 1960 will see initiation of the first comprehensive survey of switching surges ever undertaken on an American utility system. Results of this survey will significantly influence the design of future higher voltage systems. The paramount insulation coordination problem for substation equipment is protection against switching surges rather than lightning.

Westinghouse and American Electric Power are cooperating in this study to measure system voltages and currents under a variety of transient conditions—line dropping, line energizations, magnetizing current interruption and de-energization, etc. Measurements will be made on 345-kv and 138-kv circuits. Total activity will involve more than 40 major field tests.

Two areas into which these test results will flow are transformer and switchgear design. Wave shape and frequency of surges are required to determine switching surge strength and BIL. Very little field data is available on switching surges which transformers may encounter. Most information on magnitude and frequency of surges has been determined by analog computer studies. Ideally, computer studies based on field test data promise the most realistic results.

New tools and new techniques have thus been made available to Westinghouse POWERCASTING . . . a program to unearth new knowledge. In this carefully balanced study program, Westinghouse will reduce present problems to a fuller understanding of switching surges . . . leading to system design ideas that will lower utilities' EHV transmission investment.

*A Service-Mark of Westinghouse

YOU CAN BE SURE...IF IT'S Westinghouse

WESTINGHOUSE POWERCASTING*

can help you plan your system expansion ... economically, and now

Westinghouse POWERCASTING is a two-fold plan of action, designed to meet the modern problems of the industry.

HERE'S HOW YOU AND YOUR CONSULTING ENGINEER CAN PUT WESTINGHOUSE POWERCASTING TO WORK

At your request, Westinghouse will

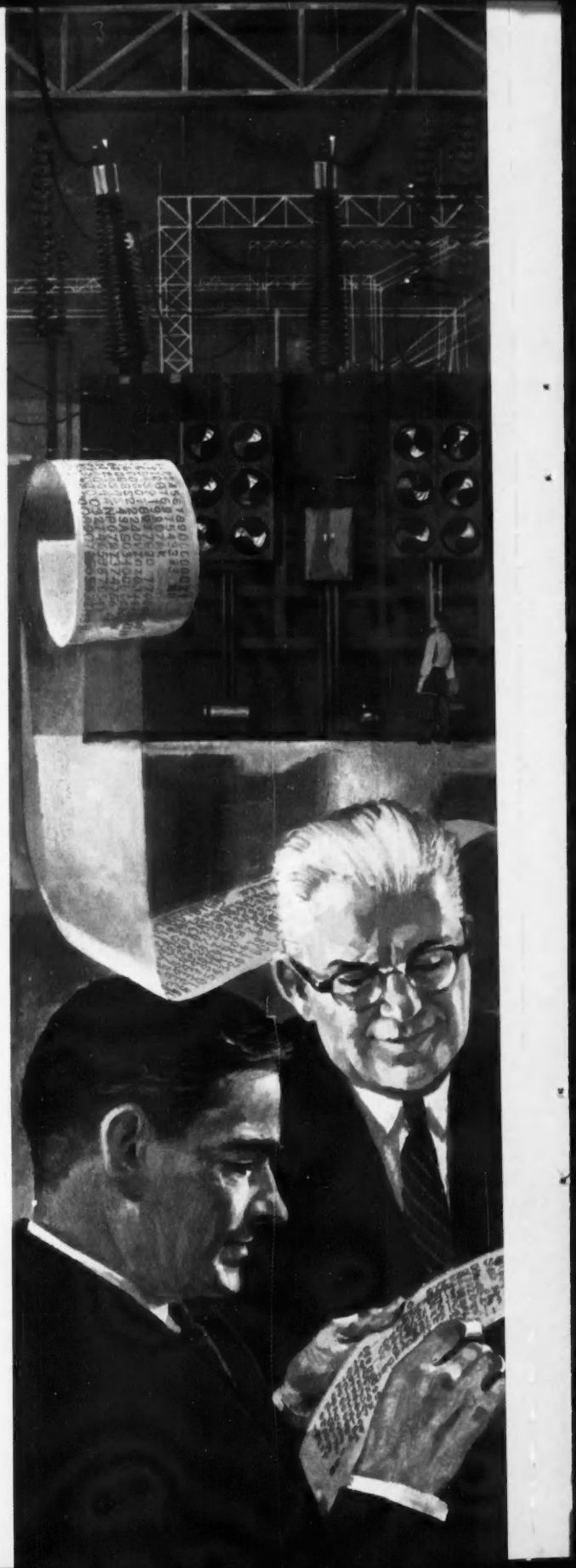
. . . Send a qualified POWERCASTING team to your office.
. . . Help you outline problems and objectives of your system.
. . . Arrange a seminar to detail project specifications.
. . . Build a mathematical model of your system.
. . . Program your future system needs and equipment investment.

Only Westinghouse offers you POWERCASTING

1. A technique for more accurate planning of future system expansion.
2. A program of product development for generation, transmission and distribution geared to the needs of future systems.

*A Service-Mark of Westinghouse

YOU CAN BE SURE...IF IT'S Westinghouse



CP-1056

Litho in U.S.A.

The Electrical Week

LATE NEWS ▶

FPC names John C. Mason to succeed Willard Gatchell as general counsel. Mason has been with the Commission since 1934, most recently as an asst general counsel.

House Government Operations Committee report claims Bureau of Reclamation is selling firm power from Central Valley (Calif.) facilities to PG&E instead of to preference customers. Report calls on Reclamation to build direct transmission from Central Valley stations if it would be cheaper than wheeling arrangements.

Connecticut L&P seeks merger or stock exchange with Housatonic Public Service Co which serves about 38,000 customers in western Connecticut. CL&P has supplied most of Housatonic's power needs for several years.

Niagara Mohawk will ask system-wide power rate increase of about $11 million or approximately 6%. Western New York industries are reportedly planning organized fight against the increase request.

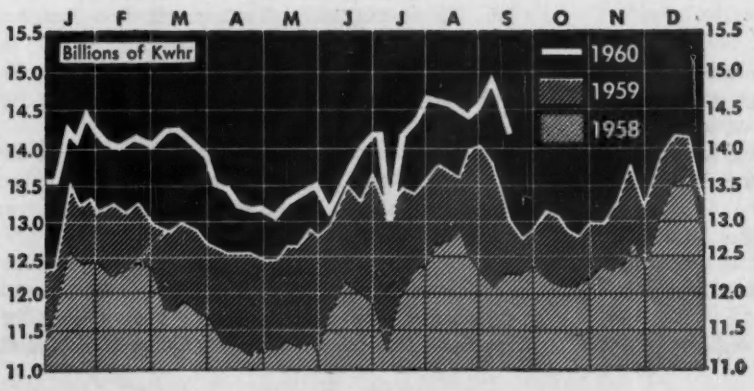
Portland GE gets FPC okay to build and operate $70.9-million Round Butte hydro project on Deschutes River in Oregon. Commission combined Round Butte license with that for Pelton Dam, issued in 1951, since PGE will operate them as a unit. Round Butte will have 247.5-Mw capacity and 250,000 acre-ft of usable storage.

FPC hearing on Appalachian Power Co's alleged violation of Commission accounting regulations will start today (Sept. 19), after one-week delay. Case involves accounting method for accrued federal income tax deferrals and could be bellwether for 10 other utilities similarly charged.

Compania Nacional de Fuerza y Luz, Costa Rican affiliate of American & Foreign Power, will market new stock issue to Costa Rican citizens in attempt to build up local financial interest and head off possible expropriation. If successful, program may be extended to other A&FP subsidiaries.

Ontario Hydro and 10,000-member union agree on new contract, dropping cost-of-living clause. Pact gives hourly workers 9¢ increase. Salaried employees get 1.5% boost and shorter work week.

WEEKLY POWER OUTPUT—Up 8.4% (Week ending Sept. 10), Kwhr 14,216,000,000



Per Cent Change From Previous Year

	Aug. 27	Sept. 3	Sept. 10
Total U. S.	+ 3.5	+ 8.6	+ 8.4
New Eng.	+ 2.3	+ 3.2	+ 4.7
Mid. Atlan.	− 0.4	+ 3.5	+ 0.1
Cent. Ind.	+ 1.5	+12.6	+10.4
West Cent.	+ 0.8	+15.3	+16.9
Southeast	+ 0.7	+ 6.7	+ 7.9
South Cent.	+12.0	+ 6.5	+15.3
Rocky Mount	+15.1	+11.8	+ 9.2
Pacific			
NW	+ 9.0	+11.0	+ 5.2
SW	+ 8.0	+ 9.5	+ 8.9

Seasonally Adjusted Index 274.7

Week Ago 274.3 Year Ago 264.2

Source: Edison Electric Institute

Preview of This Issue

EVENTS ▶ **President Eisenhower sets up conference** to look for improvement opportunities in regulatory agencies **(p 88)** . . . Hurricane Donna causes extensive utility damage from Florida Keys to northern Massachusetts **(p 89)** . . . David Hamil and Clyde Ellis have star speaking rolls at 10 regional meetings of electric cooperatives **(p 92)** . . . American Electric Power Co and its subsidiary, Kentucky Power Co, challenge Securities & Exchange policy that could affect borrowing power **(p 93).**

SPECIAL REPORT 11TH ANNUAL FORECAST ▶ **Highlights of EW's 1961-1980 forecast** which begins on page 103:

- Utilities see kwhr sales up 24.0% by 1962 vs EW estimate of 23.5% gain.
- Kwhr sales gain of 7.1% seen in 1960.
- Utility industrial kwhr sales head for 5.6% hike in 1960, 4.2% in 1961.
- Productivity must increase 46% by 1975.
- EW's 1980 forecast tops EEI and FPC targets.

ENGINEERING ▶ **Substation is shoehorned onto New Orleans site.** Built for maximum flexibility on limited space, 80-Mva unit serves half of city's commercial network load **(p 95).**

English 600-Mw power plant nearing completion is result of collaboration of the National Coal Board and CEGB **(p 97).**

Overhead distribution is boosted to 19.8 kv, relieving overloaded substation and serving without lightning arrester failure or blown fuse **(p 98).**

Politics and Public Power

'NO NEW STARTS' SHIBBOLETH

It might be prudent for the political candidates and their managers, and also the voters, to get the record straight early in the campaign as to what the Eisenhower Administration policy has been and is regarding federal public works.

Already, some sloganeering is being batted like a shuttlecock by Democratic Presidential Nominee John F. Kennedy in his campaigning through the West. And, of course, the attack on Eisenhower for a "no new starts" stand will be even louder in the Congressional races in the Northwest.

Kennedy promised federal development of water, and promised that public power groups would get the electricity from the project, not private utilities. He said that it is essential for Washington to return to the policies of the New Deal and reverse the "no new starts" cutback of Eisenhower.

So, what about the shibboleth? Is this Administration stubbornly following a policy of no new federal Corps of Engineers and Bureau of Reclamation power projects?

The label was hung on Eisenhower's budget in January, 1958. He argued that then was not the time to begin new ambitious programs; instead, there should be continuation of projects underway, amounting to some $1 billion a year. The Republicans pointed to the Upper Colorado Water Project as a monument to Eisenhower's support of federal development, but only argued that new projects could wait for awhile.

Democrats in Congress complained, and went ahead to vote money for 65 new starts. The President didn't like it, but did not veto the appropriations bill. He waited, and again announced in January, 1959, following the big Democratic sweep in November, that there should be no new starts again.

To the Democrats, the absence of any money for new projects was a signal to battle.

And they had a willing and powerful man in the person of Rep Clarence Cannon, chairman of the House Appropriations Committee and its public works subcommittee.

Beginning in the committee, and rolling on through the House, Senate Appropriations Committee and the Senate, Democrats wrote new projects into the appropriations bill for the Army Corps of Engineers

Direct conversion gains from space-flight studies, AIEE Pacific Coast meeting is told by aero-space technologists. Substations are also discussed **(p 100).**

PROCUREMENT & PRODUCTS ▸ **Holding forward commitments to a minimum** is the intention of purchasing executives until longer-term general business conditions improve **(p 126).**

Manufacturers News: Demand meter with conventional register dial is shown by GE . . . Digital computer will control Sewaren 342-Mw generating plant **(p 128).**

New Equipment: Small turbines with speeds to 16,000 rpm are available in extended line . . . Lightweight anchors are designed for easy handling **(p 132).**

MANAGEMENT ▸ **Utilities and manufacturers have much to gain** from a constructively competitive market. To accomplish this, they should do certain things—This is last of a three-part series on prices and the antitrust actions **(p 165).**

SELLING ▸ **Montana promotional rewiring campaign** brings substantial increase in residential accounts, clarifies procedures for customers, and upgrades wiring standards **(p 142).**

NEXT WEEK ▸ **The new look**—revamped EW extends its coverage, introduces new departments.

and the Bureau of Reclamation.

In the end, Congress voted money for 67 new projects. The President vetoed the appropriations bill, and Congress, for the first time in his Administration, over-rode Eisenhower.

The President, defeated, apportioned the money to the Corps of Engineers and Bureau of Reclamation to go ahead with the projects.

Later in 1959, Interior Secretary Fred A. Seaton announced the budget that was to go to Congress in 1960 (for fiscal 1961) would have some more new projects in it. He mentioned six for the Bureau, and the Corps of Engineers made up another list.

In the budget, Eisenhower asked for 42 new starts including additions to already completed projects, or projects under construction. The Democratic Congress increased that number to 65. (Eisenhower wanted authorization of the Burns Creek Project in Idaho, but Congress did not act.)

Eisenhower signed the appropriations bill. He certainly did not approve the larger number of projects enthusiastically, and he has grumbled since the defeat of a year ago that the Democrats were spending wildly. But he did not veto, and thus put the question into a political contest again.

So the "no new starts" policy was a one or two-year proposition, at most.

The Democrats in the West may persuade the voters that Eisenhower has not gone for enough federal public works, and so win in November. But the dispute in the campaign should not be one of a slogan; rather the voters should be able simply to decide how much of a federal program they want.

The Democratic platform promises: "The new Administration, with the vision that built a TVA and a Grand Coulee, will develop and conservate a heritage for the use of this and future generations. We will reverse Republican policies under which America's resources have been wasted, depleted, underdeveloped, and recklessly given away."

The Republican platform counters: "The past seven years . . . have seen the development of more power capacity, flood control, irrigation . . . and associated multipurpose benefits than during any previous Administration in history. . . . Our objective is for further growth, greater strength, and increased utilization of each great area of resources and development."

Nuclear Notes

Russian development of fast breeder reactors will provide the opportunity "to increase ten and hundredfold the existing power resources of the earth," said scientists of the Physics Institute of the State Committee on the Utilization of Atomic Energy in *Pravda*. The article, which mentioned fast breeder reactors of 50 and 200 Mw, concluded that fast breeders will soon become economically feasible.

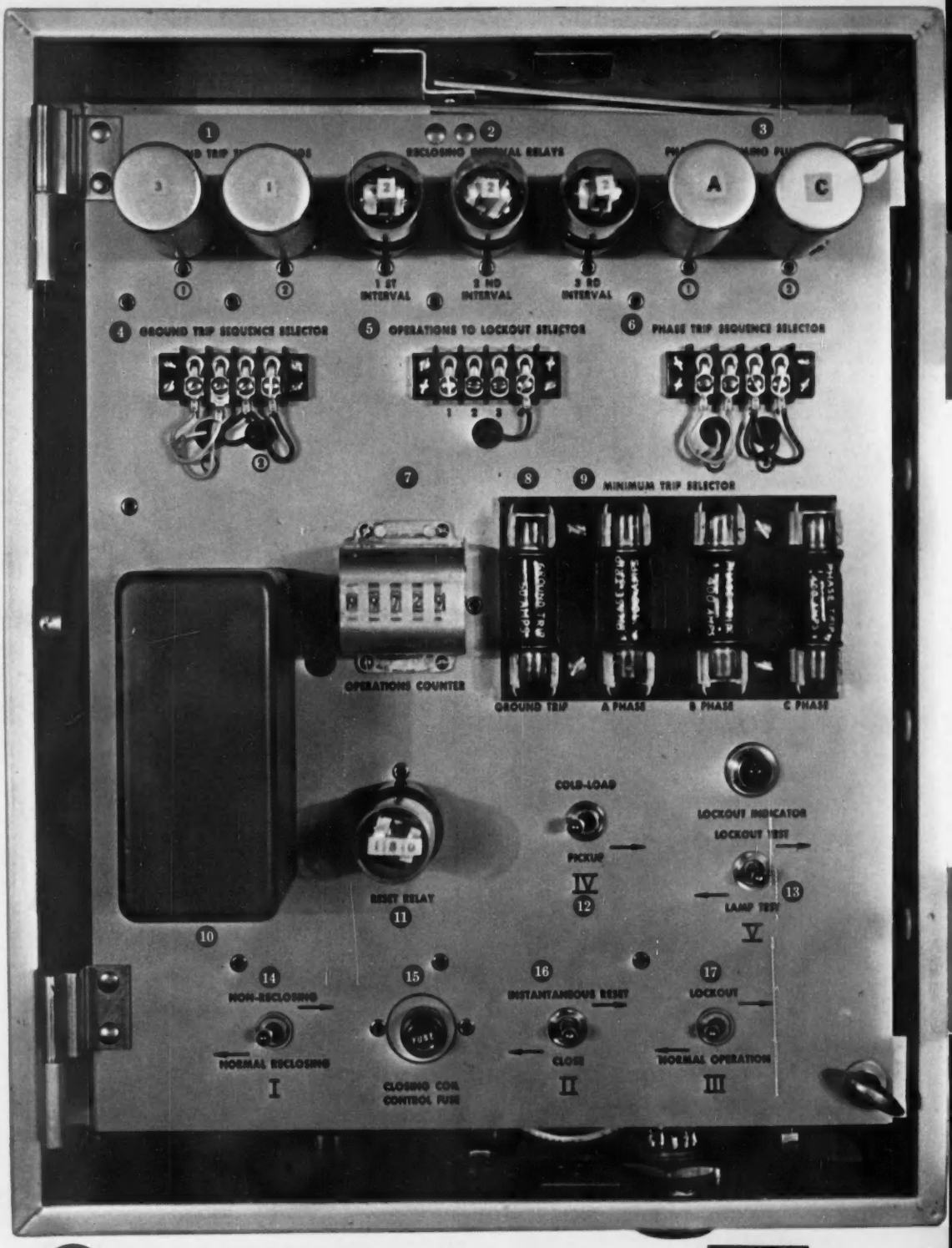
"It takes a great deal of time to check out the assumptions, or expectations, made regarding the performance of any given nuclear power plant, or fuel loading. This is the source of most of the practical problems—it takes lots of practical experience to put the problems in their proper perspective. . . . I suggest that we recognize the very preliminary nature of what has been done to date. I do not discount the vast amount of developmental data which suggests that some day we shall really be in good shape, with economic nuclear power a firm reality. I do believe that we have arrived at a point where there are now available, or soon will be available, a large number of plants which can be used to explore the multitude of detailed problems, the answers to which will tell us where and when nuclear power fits into the energy production picture."—John E. Gray, Nuclear Utility Services, Inc, in Public Utilities Fortnightly, Sept. 1, 1960.

"It is only by operation of reactors that one can achieve confidence in the technical and economic calculations which are necessary for sound evaluation of nuclear power plants. . . . It would be very surprising, indeed, if a single reactor concept should emerge as offering the best performance for the wide range of sizes and for the wide range of applications and local situations for which nuclear power has potential value. . . . The present status of nuclear power development may be described as a transition phase wherein some reactor concepts appear to be economically justified, or nearly so, in special situations."—Ulysses M. Staebler, Senior Assistant Director, Division of Reactor Development, US Atomic Energy Commission, in a speech in Vienna, Sept. 5, 1960.

Regulations on radiation exposures permitted have been revised by the AEC. The major result of the changes is to lower the allowed lifetime accumulated dose to radiation workers to one-third that now allowed. The new limit will be 5 rem (roentgen equivalent man) per year, with limits for various parts of the body. The regulations also restrict concentrations of radioactive materials that employers may have on hand. The proposed new rules were published for comment last year and, since talks with industry and with the AFL-CIO, have been modified. They will go into effect Jan. 1, 1961.

In considering a construction permit for the planned Peach Bottom nuclear plant, the Circuit Court decision on Enrico Fermi cannot be used as a precedent, since the mandate of the Circuit Court permitted construction to continue, pending outcome of the appeal to the Supreme Court, says Neil D. Naiden, AEC acting general counsel. Also, since the Commission regards the decision on PRDC erroneous, the AEC does not regard it as yet legally applicable to either the Fermi reactor or the Commission's reactor licensing program. Naiden was replying to Rep James M. Quigley, Democrat from the district where Peach Bottom is to be built. Quigley has attacked the two-step licensing procedure of the AEC and said that he will intervene in hearings on a construction permit for the plant.

L-M ANNOUNCES



LINE MATERIAL® Industries
McGRAW-EDISON COMPANY

483 *Reclosers, Sectionalizers, and Oil Switches*

DISTRIBUTION TRANSFORMERS • RECLOSERS, SECTIONALIZERS AND OIL SWITCHES • FUSE CUTOUTS AND FUSE LINKS • LIGHTNING ARRESTERS • POWER SWITCHING EQUIPMENT
PACKAGED SUBSTATIONS • CAPACITORS • REGULATORS • OUTDOOR LIGHTING • LINE CONSTRUCTION MATERIALS • PORCELAIN INSULATORS • FIBRE PIPE & CONDUIT

How The L-M Electronic Control Works

L-M's revolutionary new Electronic Control provides accurate and dependable opening and closing of reclosers as dictated by your coordination scheme. L-M Reclosers with Electronic Control offer the simplest, most flexible and most stable means of protecting and assuring the continuity of service. All problems, whether protection or coordination, can be solved, and at a lower cost than comparable protective devices.

This new control is contained in a cabinet separate from the recloser. Remote control and remote indication are easily added. The panel features unitized construction for test or replacement. Component changes can be made right on the panel without service interruption.

Self-contained current transformers supply the control with an indication of phase current. Depending upon the current and the time-current characteristics selected, the control computes opening time and directs recloser to open. After the selected reclosing interval has elapsed, the recloser will close. Sequence relay operates to the second selected time-current characteristic and reclosing interval.

If fault or high-current persists, control will continue to operate in a similar manner until the recloser locks open.

Optional ground-current tripping is similar to phase-current tripping.

Power for the control system is supplied by a 24-volt sealed nickel-cadmium battery. No external power supply is required to operate this electronic control. A Zener diode trickle charging circuit with separate bushing current transformer keeps battery at peak power. Power for closing recloser is supplied by the distribution lines.

REFER TO NUMBERS ON PANEL AT LEFT.

1 GROUND-TRIP TIMING PLUGS—sealed circuit of solid-state components provide a choice of two time-current characteristics for ground current tripping. Any two time-current characteristics may be selected from curves 1, 2, and 3. Characteristics may be field changed by simply plugging-in a different choice. (OPTIONAL)

2 RECLOSING INTERVAL RELAYS provide choice of 8 time intervals from ½ second to 60 seconds between successive reclosings. Relays may be field changed simply by plugging-in a different choice.

3 PHASE TRIP TIMING PLUGS—sealed circuit of solid-state components, provide a choice of two time-current characteristics for phase current tripping. Any two time-current characteristics may be selected from X, A, B, C, D or E curves. Characteristics may be field changed by simply plugging-in a different choice.

4 GROUND TRIP SEQUENCE SELECTOR—connections at this terminal board determine the sequence of time-current characteristics for ground-current tripping. Any sequence may be obtained. Field changes are simply made by reconnection of terminal board. (OPTIONAL)

5 OPERATIONS TO LOCKOUT SELECTOR—connection to terminal 1 through 4 determines the number of operations before reclosers remain open. Selection may be field changed by reconnecting to desired terminals.

6 PHASE TRIP SEQUENCE SELECTOR—connections at this terminal board determine the sequence of time-current characteristics for phase-current tripping. Any sequence of the two selected time-current characteristics may be obtained. Field changes are made simply by reconnection of this terminal board.

7 OPERATIONS COUNTER—electrically operated counter indexes one digit each time the recloser opens.

8 MINIMUM GROUND-TRIP SELECTOR—resistance cartridge determines the minimum ground-trip current. Cartridge is marked in amperes. Field changes may be made simply by replacing with cartridge for desired trip current without tripping recloser. (OPTIONAL)

9 MINIMUM-TRIP SELECTOR—resistance cartridges determine the minimum-trip current for each phase. Cartridges are marked in amperes. Trip current may be different for each phase. Field changes may be made by simply replacing with cartridge for desired trip current. Recloser need not be tripped open when field changes are made.

10 SEQUENCE RELAY—sealed relay provides sequencing for the control circuit.

11 RESET RELAY—sealed thermal time-delay relay resets control circuit if fault clears before entire sequence of recloser operates to lock out. A new sequence of operations will be performed when another fault occurs. Choice of intervals from 9 relays with range of 10 to 180 seconds—interval must be greater than time of complete recloser sequence. Field changes are made by plugging-in desired relay.

12 COLD-LOAD PICKUP—momentary switch to prevent recloser from opening during current surges when service is restored after extended outages.

13 LOCKOUT INDICATOR—signal lamp for visual indication when recloser locks open. Momentary switch tests the lamp in one direction, and indicates lockout of recloser in the other direction.

14 NON-RECLOSING-NORMAL RECLOSING—permits elimination of control sequence. With switch in non-reclosing position, recloser will operate once and lock out.

15 CLOSING COIL CONTROL FUSE—when line voltage is too low to reclose, fuse blows to prevent operation of closing solenoid coil contactor.

16 INSTANTANEOUS RESET-CLOSE—switch by-passes the normal reset time delay relay in one direction and closes recloser in the other direction.

17 LOCKOUT-NORMAL OPERATION—switch will permit locking recloser open from the control panel. Recloser will not close unless this switch is returned to the "NORMAL OPERATION" position.

New Electronic Control For Reclosers

The New L-M Electronic Control gives Relay, System Protection, and Substation Engineers what they have always wanted—speed, accuracy, accessibility, flexibility.

Oil Circuit Reclosers as developed by Line Material are universally accepted as tremendously efficient, cost-saving protection for distribution lines and substations.

One reason for L-M's outstanding leadership in reclosers has been the L-M-developed hydraulic control, an extremely dependable self-contained unit that permitted engineers to solve protection problems simply.

Today, Line Material announces another revolutionary new engineering development—the Electronic Control.

The L-M Electronic Control consists of solid-state transistorized sensing and control devices; time-delay relays for resetting and reclosing; provisions for ground current tripping; test and control switches; and plug-in electronic components to provide for changing time-current curves and sequences without service interruptions. The L-M control provides greater flexibility, greater accessibility, and a wider choice of time-current curves than have been available even with L-M's outstanding hydraulic control.

This new control is available with both
L-M Type RE and Type WE Reclosers.

The Greatest Advance in Reclosers

Since L-M Developed the Hydraulic Control

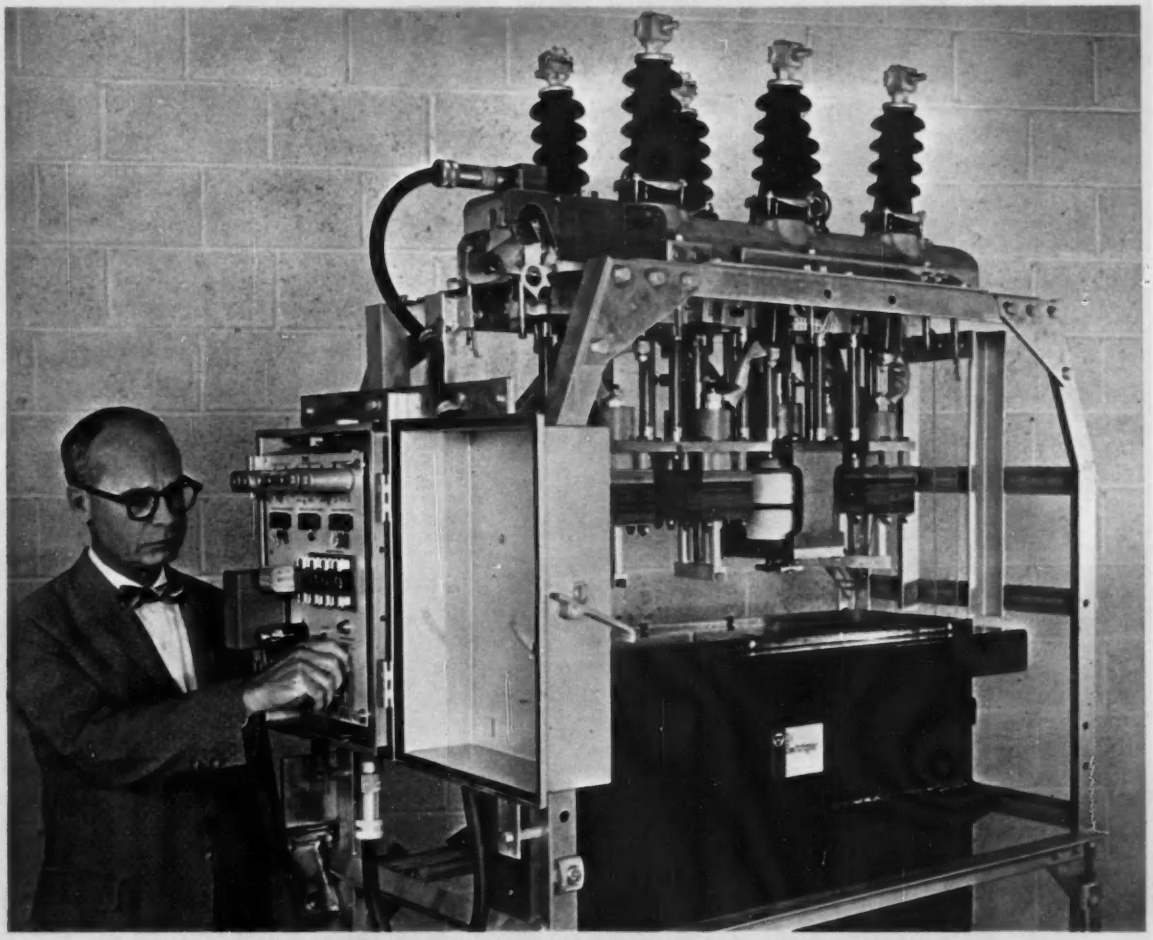
L-M's New Control has been thoroughly tested. It provides the engineer with a wide choice of time-current curves and operating sequences. Equipment and components are easily accessible for testing, for changes in timing and sequencing to meet the most accurate coordination requirements.

A wide choice of control possibilities are already built-in: remote operation, cold-load pickup, with optional ground current tripping available.

Never before, in any type of apparatus, has the engineer found such great convenience, such dependable accuracy, such flexibility, and such economy, as are provided by the revolutionary new Line Material Type RE and Type WE electronically controlled reclosers.

Now Get Electronic Coordination

Get complete details on this outstanding improvement by Line Material in automatic line protection. Ask the L-M Field Engineer for Product Information Bulletin CR1WE, and ideas on how you can take advantage of this remarkable new development in oil circuit reclosers. Call the nearest L-M office; or phone or write Line Material Industries, Milwaukee 1, Wisconsin. In Canada: CLM Industries, McGraw-Edison (Canada) Limited, Toronto 13, Canada.



N. K. Delaney, Product Manager, Switchgear and Capacitors, checks out the lockout indicator and signal lamp on the Electronic Control. Note that the control is connected to the recloser with a flexible cable and plug-in receptacles, so that the control can be mounted at any location.

AVAILABLE FOR BOTH TYPE RE AND TYPE WE RECLOSERS

Type RE: 400 amperes continuous with 7 trip current ratings from 100 through 800 amperes in voltages from 2.4 through 14.4 kv. Interrupting capacity to 6000 amperes at 4.8 kv, 5000 amperes at 8.32 kv and 4000 amperes at 14.4 kv.

TYPE WE: 560 amperes continuous with 6 trip current ratings from 200 through 1120 amperes in voltages from 2.4 through 14.4 kv. Interrupting capacities to 12,000 amperes at 4.8 kv, 10,000 amperes at 8.32 kv and 8000 amperes at 14.4 kv.

LINE MATERIAL® Industries

McGRAW-EDISON COMPANY

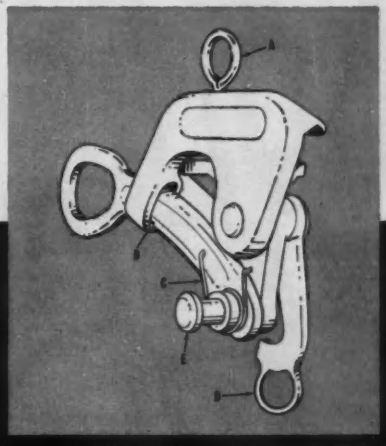
McGRAW EDISON

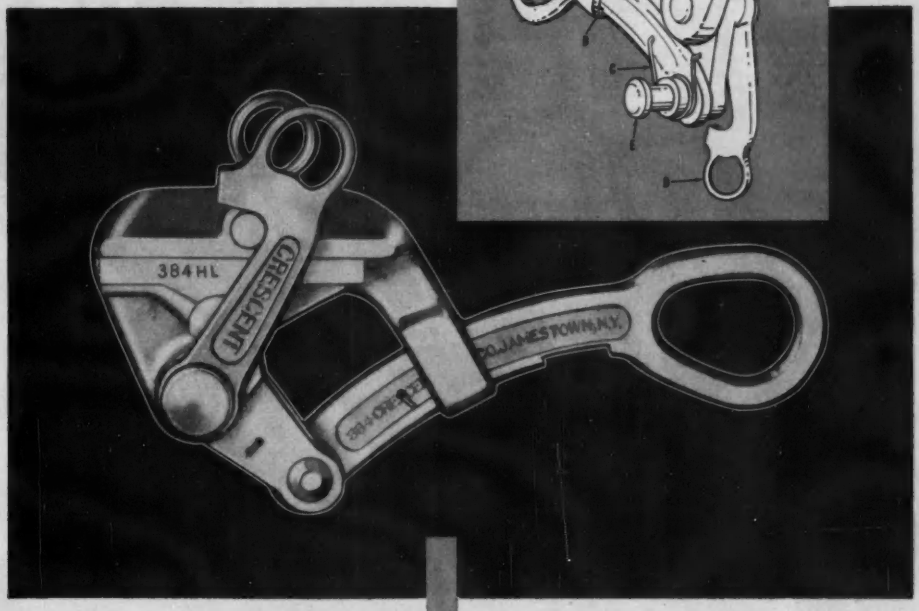
Reclosers, Sectionalizers, and Oil Switches

DISTRIBUTION TRANSFORMERS • RECLOSERS, SECTIONALIZERS AND OIL SWITCHES • FUSE CUTOUTS AND FUSE LINKS • LIGHTNING ARRESTERS • POWER SWITCHING EQUIPMENT
PACKAGED SUBSTATIONS • CAPACITORS • REGULATORS • OUTDOOR LIGHTING • LINE CONSTRUCTION MATERIALS • PORCELAIN INSULATORS • FIBRE PIPE & CONDUIT

CRESCENT HOT LINE GRIPS

FOR SAFE, REMOTE OPERATION WITH HOT LINE STICKS





▶ These grips are an adaptation of the standard Crescent Grip which has earned a reputation with line crews everywhere for being jamproof, slip-proof and instantly releasing.

Operation is simple for linemen familiar with the use of hot line sticks. Grip is held open by engaging notch "B" in bottom of frame loop. Grip is then placed on wire by means of eye "A". Latch "D" is swung into place with hot line stick. Jaws are closed by action of spring "C" when engagement of notch "B" is tripped by upward movement of the pulling eye arm. Grip is released by placing hot line hook on rivet stud "E" and pulling until notch "B" engages frame loop.

Made in three sizes; each grip tested to its safe load capacity. Cadmium plated.

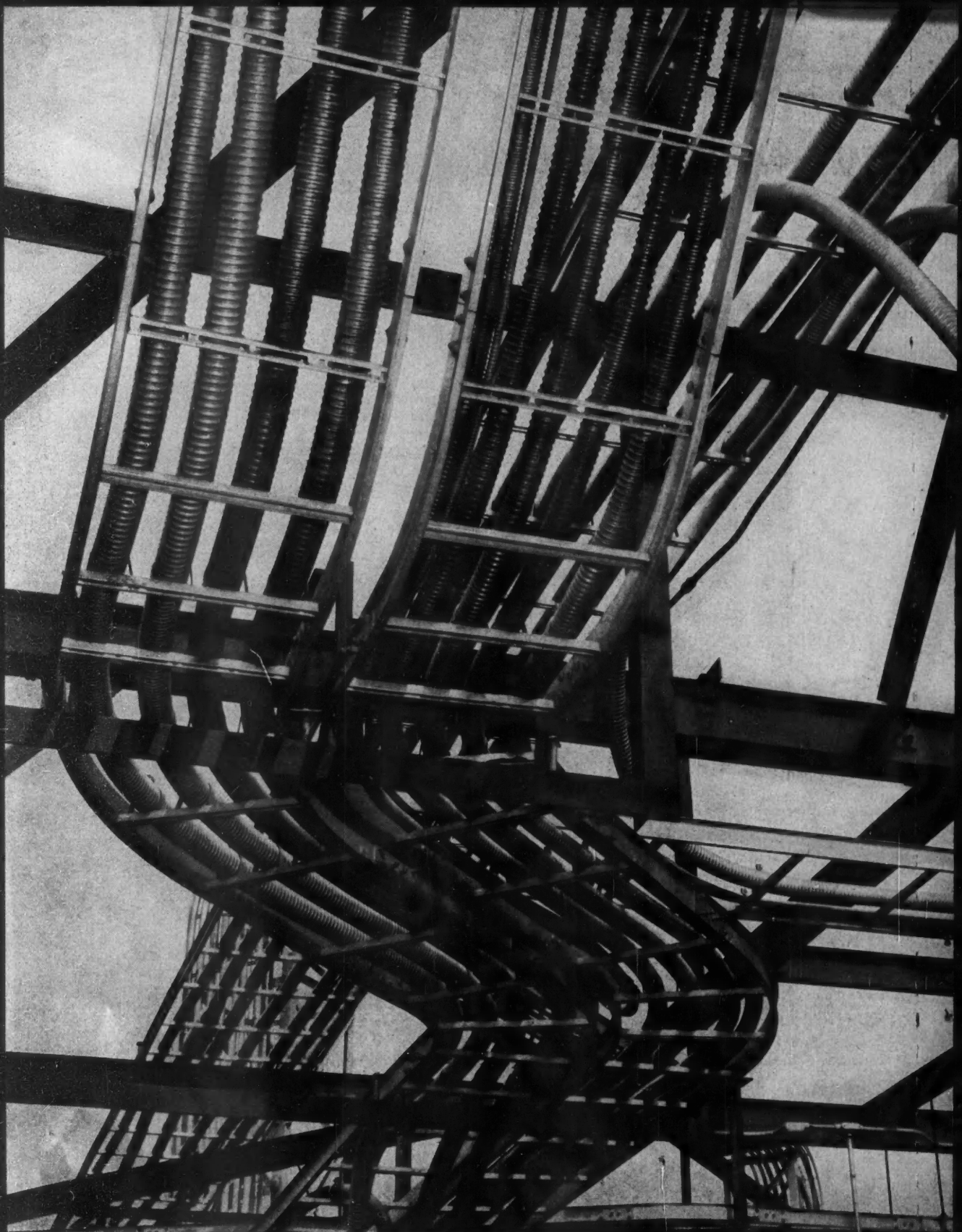
SPECIFICATIONS

SERRATED JAWS	MAXIMUM CAPACITY	MINIMUM CAPACITY
No. 383 HL	5/16 (.3125)" 8 mm	5/32 (.156)" 4 mm
No. 384 HL	1/2 (.500)" 12.2 mm	1/4 (.250)" 6.5 mm
No. 385 HL	3/4 (.750)" 19 mm	3/8 (.375)" 9.5 mm

No. 383-2 HL, 384-2 HL and 385-2 HL same, except with smooth jaws for bare aluminum wire.

Crescent is our trade-mark, registered in the United States and abroad, for wrenches and other tools. Sold by leading distributors and retailers everywhere and made only by

CRESCENT TOOL COMPANY, JAMESTOWN, NEW YORK



USS Tiger Brand Armorlokt cable in open racks costs less to install, carries more power and can be easily maintained.

Power for new refinery supplied by overhead installation of USS Tiger Brand Armorlokt Cables

Electrical power for this highly automated refinery of the Standard Oil Company (Ohio) at Toledo, Ohio comes into the transformers at 69,000 volts and is stepped down to 4,160 volts for the various power feeders. These are carried to unit substations of the processing plant on racks supporting the USS Tiger Brand Armorlokt Cable. At the substations, the voltage is reduced to 440 volts and from there is run to the starter racks for motors which drive the process pumps.

This is the first time that armored cable has been used in any of Sohio's refineries. The initial cost was less than for a conduit or concrete duct installation in the ground. The cables in air have a higher current carrying capacity for a given size cable. Since heat can dissipate quickly, a smaller cable can be used to carry the same power.

Less costly construction was possible at substations because the Armorlokt Cable was easily accessible from overhead and did not require the construction of conduit openings in a concrete ground slab.

Flexibility. Besides ease of installation, USS Tiger Brand Armorlokt Cable can be readily run around obstructions, because of its flexibility. Capacity can be quickly and economically added for future needs for more power.

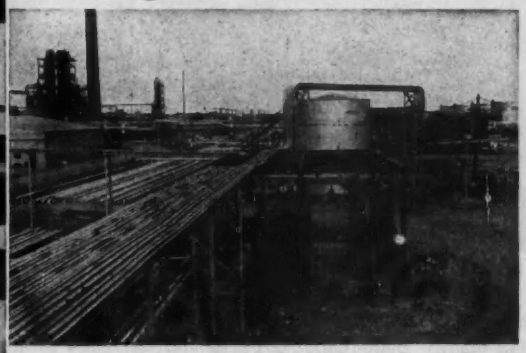
Why not investigate USS Tiger Brand Armorlokt Cable—not only for new installations but for bringing old systems up to date with the least cost for installation. Write or call American Steel & Wire, 614 Superior Ave., N. W., Cleveland 13, Ohio.

USS, Tiger Brand and Armorlokt are registered trademarks

USS Tiger Brand Electrical Wire & Cable

A standard cable for every special job

- Asbestos Wire and Cable
- Mold-Cured Portable Cord
- Shovel & Dredge Cable
- Paper & Lead Cable
- Varnished Cambric Cable
- Interlocked Armor Cable
- Special Purpose Wire & Cable
- Aerial, Underground and Submarine Cable



Substation showing cable racks supporting USS Tiger Brand Armorlokt Cable with varnished cambric insulation. Sizes include cables of 500 MCM with voltages of 5,000 and 600 volts.

New Standard Oil Company (Ohio) refinery at Toledo, Ohio with a capacity to process 60,000 barrels of crude oil per day. Engineers and constructors: The M. W. Kellogg Co., Electrical Contractors: W. W. Clark Corp.

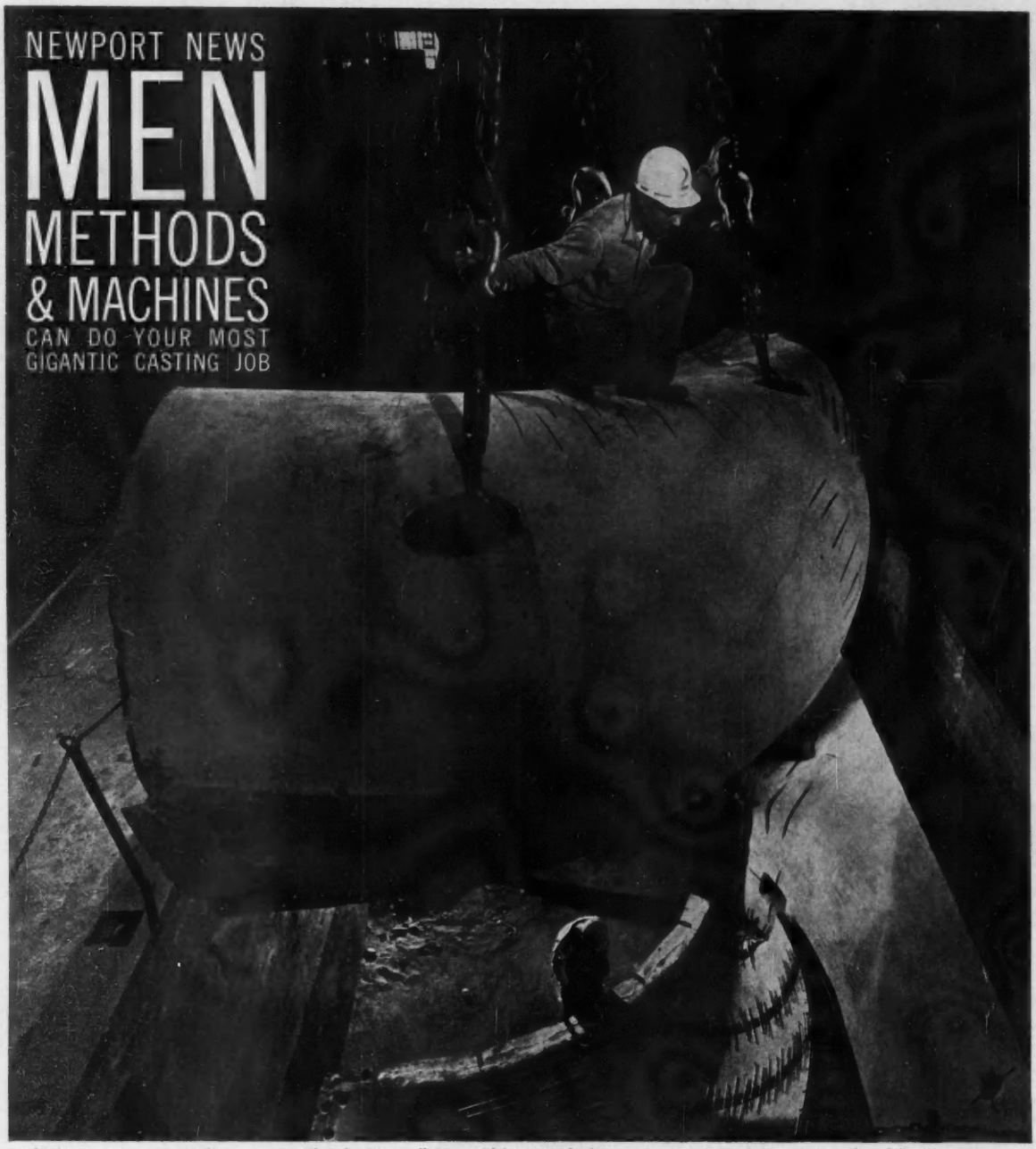
American Steel & Wire Division of United States Steel

Columbia-Geneva Steel Division, San Francisco, Pacific Coast Distributors
Tennessee Coal & Iron Division, Fairfield, Ala., Southern Distributors
United States Steel Export Company, Distributors Abroad

NEWPORT NEWS

MEN METHODS & MACHINES

CAN DO YOUR MOST GIGANTIC CASTING JOB



Mold for a section of a turbine stay ring for the Hartwell Power Plant. It is the largest one-piece Y-casting ever produced by Newport News.

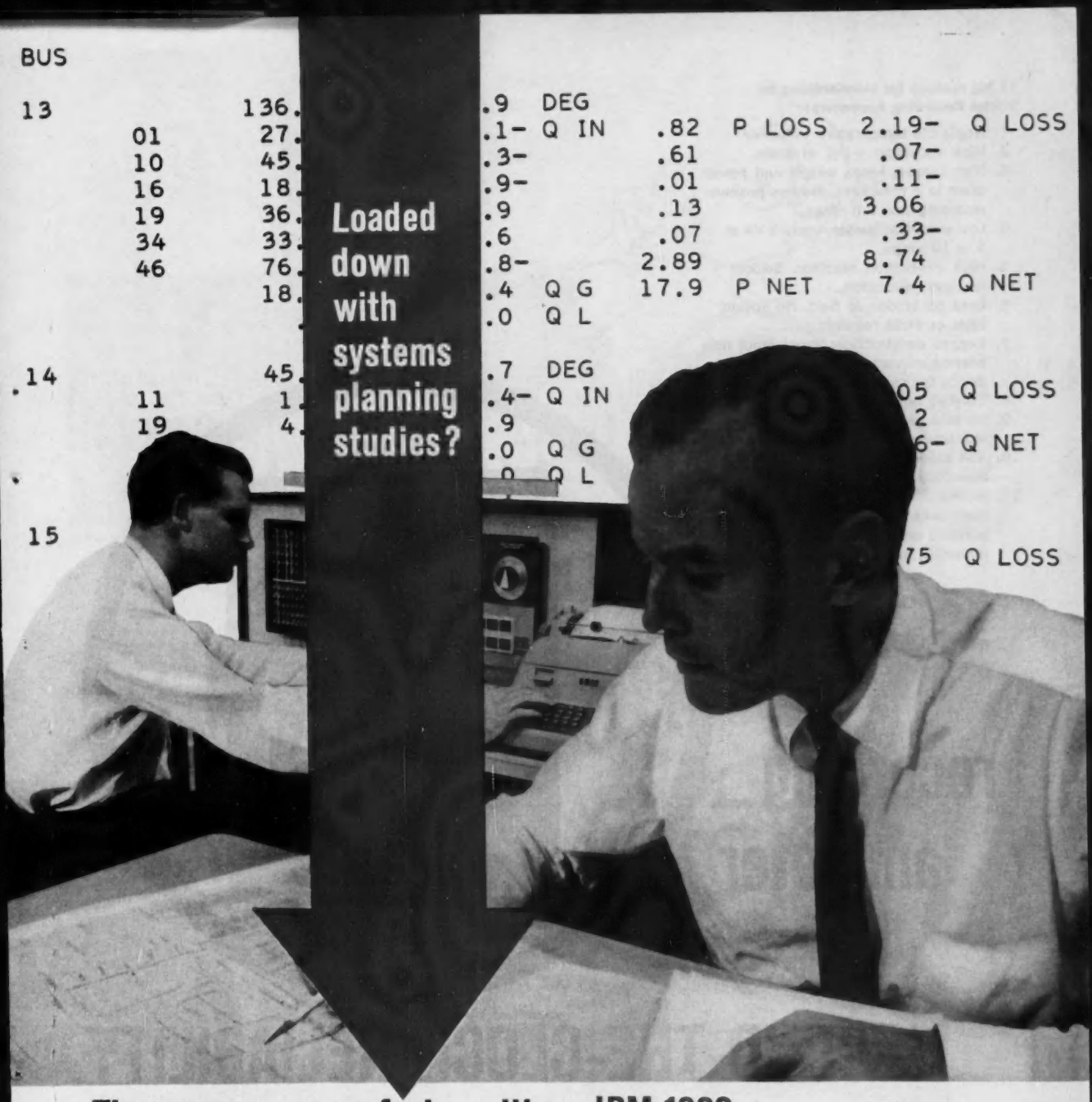
It takes all three—men, methods and machines to tackle a job as big as this one! Newport News has completed many of them including six hydraulic turbines for the Niagara Project, four for the Hartwell Power Plant, and many others.

Newport News not only cast this giant unit but also milled it—and built the boring mill that did the work! No challenge is too great.

The secret of its leadership in the fabrication of heavy equipment is its staff of highly trained engineers and technicians, thousands of skilled workmen and 225 acre plant capable of turning out such projects as hydraulic turbines and valves, vacuum or pressure vessels for the petrochemical industry, bridge caissons, wind tunnels, and pulp and paper equipment.

Consult Newport News for preliminary recommendations at no obligation.

Newport News
SHIPBUILDING AND DRY DOCK CO.
NEWPORT NEWS, VIRGINIA



The answers come faster with an IBM 1620

Load studies for systems up to 150 buses and 200 lines are made quickly, accurately, and economically with the new Load Flow Program for the solid state IBM 1620 . . . most powerful engineering computer in its low price class.

Given scheduled power input and voltage magnitude or real and reactive loads at the terminals of a passive system, the program **automatically** computes—**and prints out fully in any desired combination**—complete data on:

- Voltage and angle
- Net power
- Load and generation
- Line flows
- Line losses

Provision is made for direct entry to the base case of changes in loads, generation, transformer taps and capacitors. Studies may be interrupted at any time to evaluate progress completely. Because complete data is filed, supplementary cases for a given system may be run at any later time with no penalty in time or money for setting up.

Backing up the 1620 Load Flow Program are many other Library Programs helpful in solving utility engineering design, system planning, and operation problems. IBM's long leadership and experience in data processing for public utilities assures you truly Balanced Data Processing.

For full details on the 1620 call your nearest IBM office.

BALANCED DATA PROCESSING

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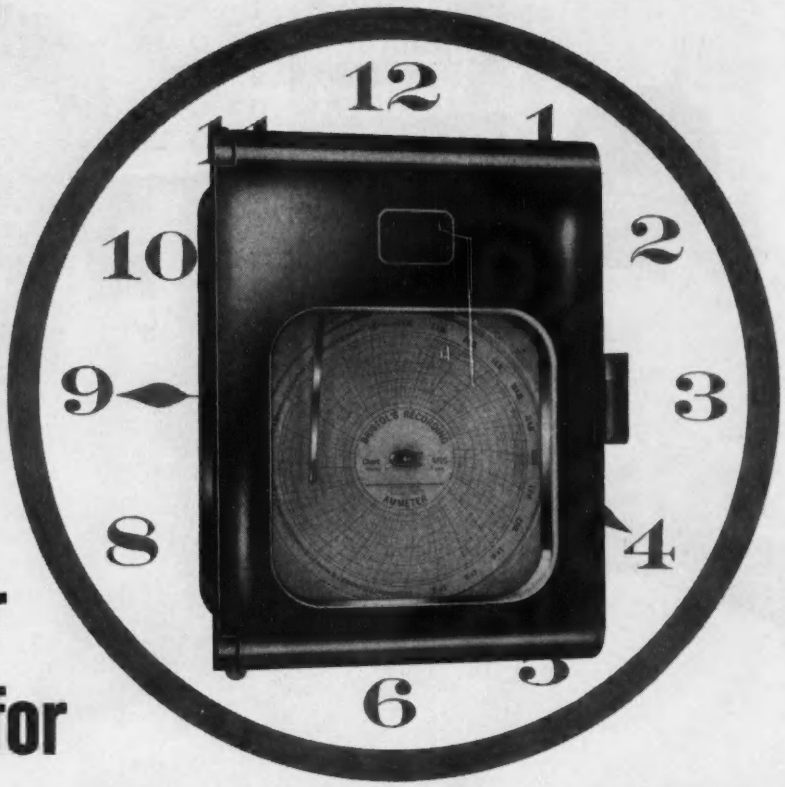
11 big reasons for standardizing on Bristol Recording Ammeters:

1. Negligible temperature influence.
2. High accuracy: ±1% of scale.
3. High torque, keeps weight and power drain to a minimum, assures positive recording over full range.
4. Low electrical burden—only 5 VA at 5 or 10 amps.
5. High calibration stability. Seldom requires calibration.
6. Easy calibration in field. No special tools or skills required.
7. Rugged construction: Shock-proof ball-bearing movements; pen locking device for shipping or carrying.
8. Leveling not critical.
9. Up to 3 pens—for recording up to 3 independent readings.
10. ASA models available; Meet Specifications C39.2-1953.
11. Models for wall, switchboard, flush-panel, pole-mounting, portable and portable pole-mounting use.



The recording ammeter for 'ROUND-THE-CLOCK RELIABILITY

. . . It's a Bristol, of course . . . featuring time-tested moving-iron elements, refined and improved by Bristol R & D

Bristol recording ammeters give you maximum accuracy and reliability under field conditions—all the time.

Big reason is Bristol's ultra-reliable, moving-iron element—the same high-torque, low-burden element that has earned Bristol such a reputation for accuracy and dependability in thousands of installations . . . in electric utility central stations, substations, distribution systems . . . in industrial and process plants.

Bristol recording ammeters, while employing the ultra-reliable, time-tested moving-iron mechanism, incorporate basic improvements and design innovations which make them outstanding for accuracy, ease of calibration, and dependable operation under difficult conditions.

Models with up to three pens, actuated by independent elements, are available as are models for every mounting requirement, chart-drive requirement, or range requirement—all the features are detailed in Bulletin E1111. Write for your copy today. The Bristol Company, 116 Bristol Road, Waterbury 20, Conn. O.4

BRISTOL . . . for improved production through measurement and control

AUTOMATIC CONTROLLING, RECORDING AND TELEMETERING INSTRUMENTS

Central's NEW

OWL
OVERLOAD WARNING LIGHT

gives POSITIVE indication that transformer hot spot copper temperature has exceeded 105° C.

It provides the Utility with a simple, inexpensive guide to transformer thermal load condition. It is clearly visible from a cruising service truck. It responds to coil temperature rather than top oil temperature.

- O-W-L is lightweight and small but very rugged—not subject to easy damage in shipping and handling.
- O-W-L is simple and easy to re-set, either by hand or with hot stick.
- O-W-L is designed to permit removal of core and coil assembly without removing the light.
- O-W-L does not interrupt service in any way. Replacement or other system changes can be made at Utility's convenience.

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Transformer Corporation
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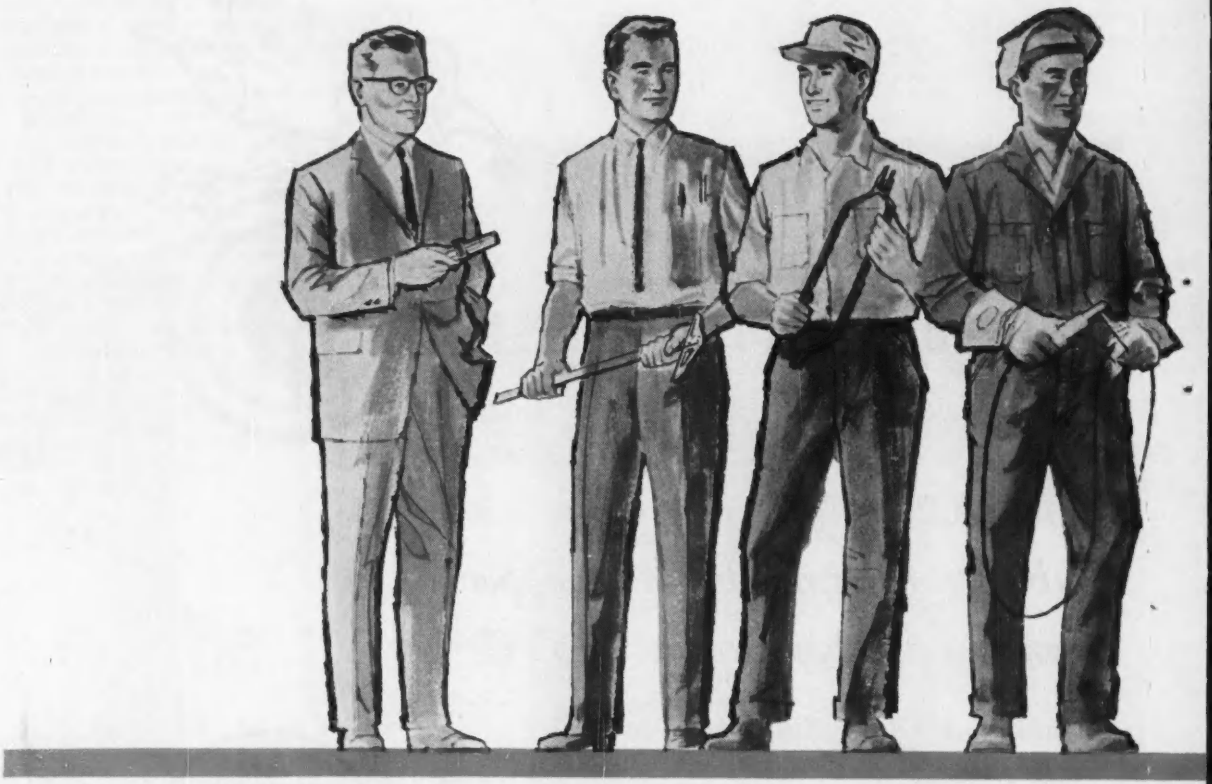
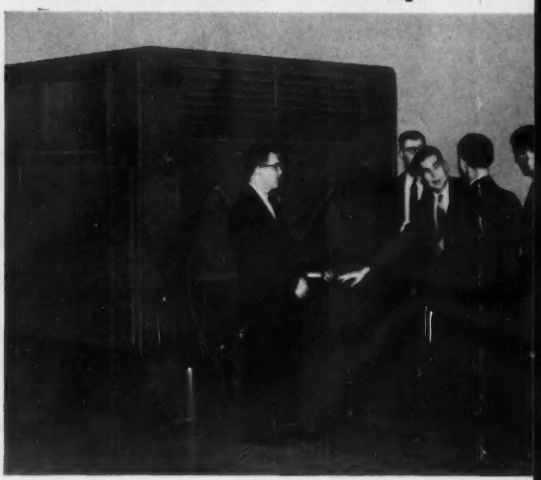


Here's a record of design features developed

Flexibility in "little things" (above) include: a chamfer, which simplifies bearing cap removal; an air filter which is easier to replace; optional oversize conduit boxes; a chained, tapered oil-ring inspection plug.



A boon to boiler-room attendants and to neighbors of power stations is the super-quiet boiler feed pump motor pioneered by Elliott in 1954. The largest motors of this type in service are Elliott.

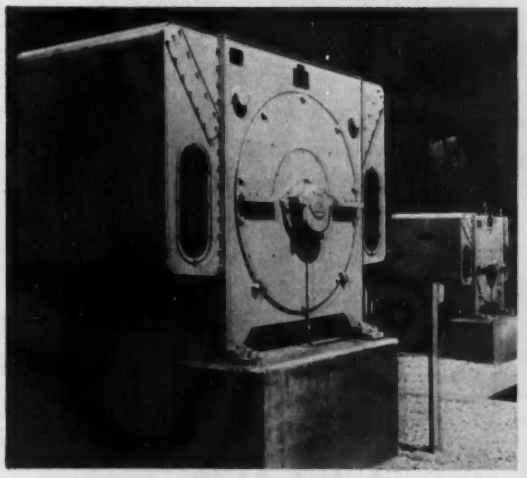
READY, ABLE & WILLING

—if you'll let us!

Open-mindedness is an Elliott characteristic that motor buyers like. Traditionally, Elliott has had a willingness to accept new ideas, the ability to translate user's needs into motor designs, the facilities to produce large motors of highest quality. The entire Elliott engineering and production staff—from application engineer to expediter—is organized to carry out this policy.

Some of the design features developed at the suggestion of utility engineers are briefly described below. Other basic Elliott developments include FABRI-STEEL welded frame construction, and the record-shattering FABRI-SEAL insulation system for motor coils. These and other Elliott features are responsible for the solid record of outstanding performance in hundreds of utility powerhouses throughout the United States.

in cooperation with utility engineers

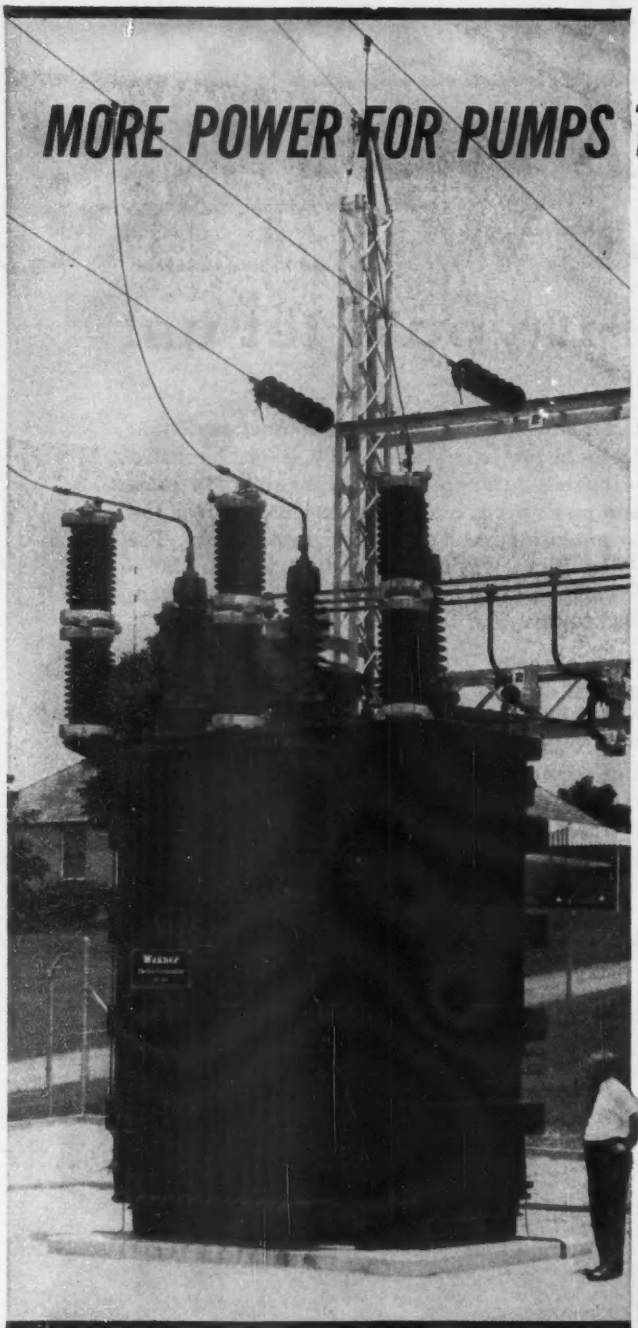


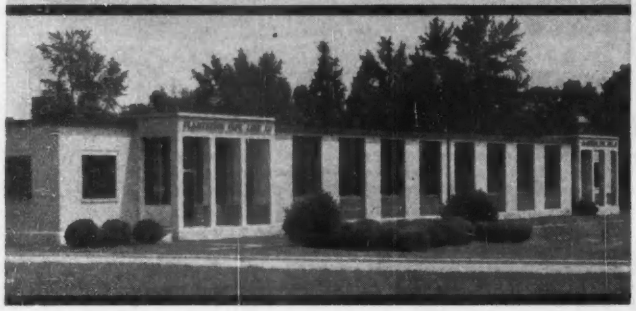
Advent of outdoor power stations created a demand for an "outdoor" type motor. Elliott was the first to produce a weather-protected motor, and in the process, developed the famous FABRI-SEAL insulation system which has set the pace for the industry.

Maintenance requirements of a midwest utility made "easy access" necessary; Elliott ingenuity and flexibility made it possible. The result—easier, faster inspection and cleaning of large motors.

RO-8

ELLIOTT Company
RIDGWAY PLANT, RIDGWAY, PA.





MORE POWER FOR PUMPS THAT PUSH PETROLEUM

THIS WAGNER TRANSFORMER

POWERS-UP

PLANTATION PIPELINE

The Plantation Pipeline Company pumping station at Neese, Georgia, is part of an underground transportation system that pushes high quantities of petroleum products to their market.

The Neese operation was originally served with power from a 44 kv system substation. However, the size of the pumping load—which includes some 1800 hp motors—became too great for the substation to handle adequately.

To better serve the load, Georgia Power Company recently installed a 110 kv line and built a new substation. Wagner Electric Corporation furnished the transformer rated at 7500 Kva for this purpose. Today, Plantation Pipeline pumps with full power.

Now, what about your power needs? If they present a critical (or even a potential problem), call your nearby Wagner Sales Engineer. He'll help you plan your power program . . . suggest Wagner transformers that will meet your needs for years to come. There are Wagner branches in 32 principal cities.

Wagner Electric Corporation

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SERVING 2 GREAT GROWTH INDUSTRIES—*ELECTRICAL • AUTOMOTIVE*

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including only those installations operating at 600 p.s.i. or more, and costing $50,000 or more!

Write for new 24-page brochure, POWER AND PROCESS PIPING

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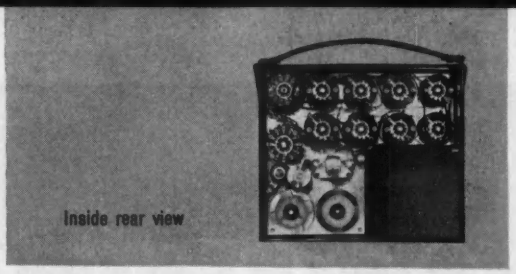
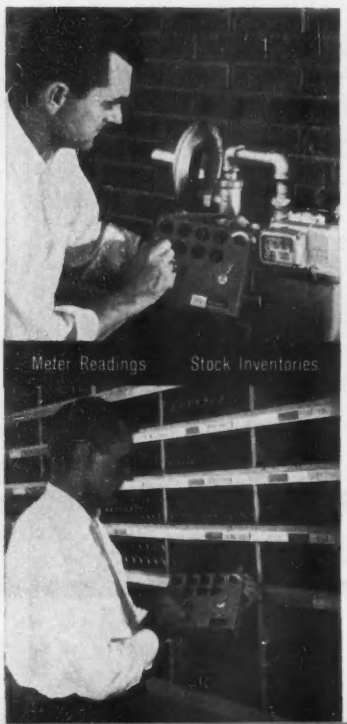
MIDWEST PIPING COMPANY, INC.

VERSATILE
WEATHERPROOF
AUTOMATIC

METERCORDER


Inside rear view

The METERCORDER is the *first* portable digital tape recorder. It was developed specifically for use in domestic meter reading by utility companies. During the United Gas Corporation's testing period, the Metercorder proved its adaptability for all types of data gathering in retailing and industry. Numbers set into the dials are recorded on ¼-inch magnetic tape by a single stroke of the recording lever. A Metercorder model adapted for your needs records the data you want in one fast, completely automatic operation.



UGC METERCORDER IS . . . . . .

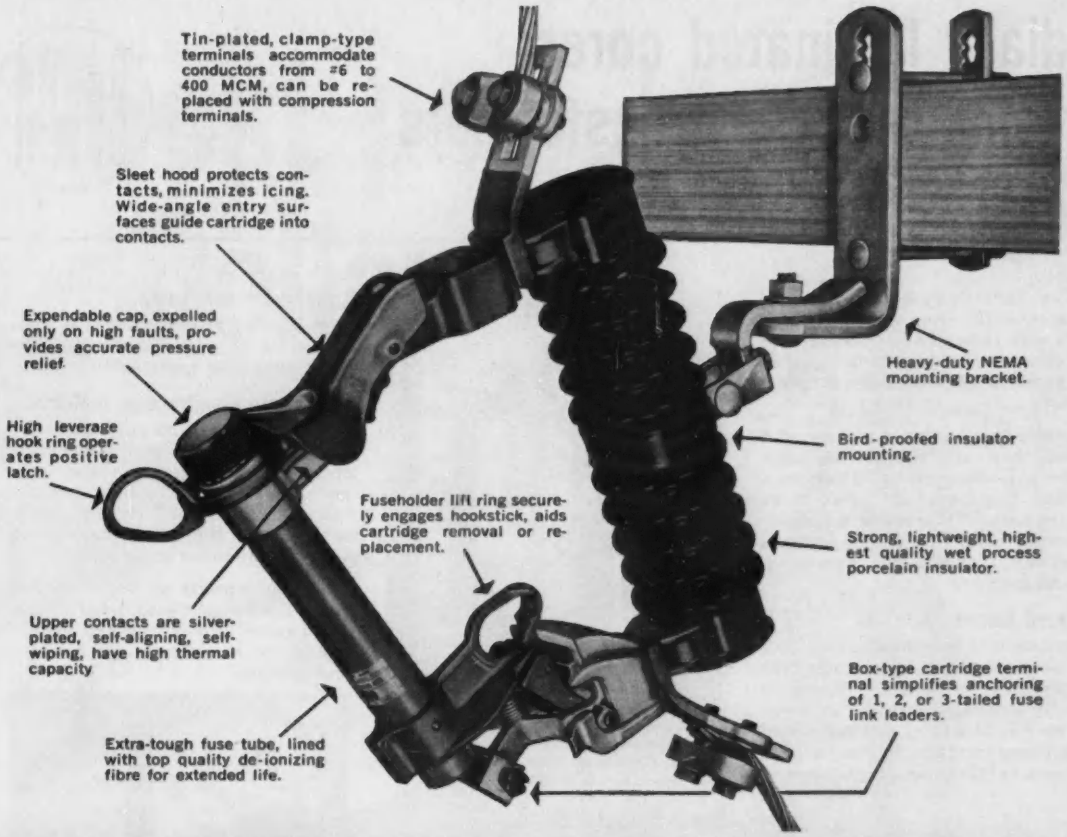
* Sturdily built
* Weighs just 2½ pounds
* Contains no vacuum tubes, oscillator circuits or transistors
* Powered by one 1½ volt penlight battery
* Completely waterproof and weatherproof
* Easy to operate . . . even by gloved hands

UGC Instruments INTERPRETER (pictured at right) translates the recorded information to the computer language used: directly to the computer, to punched paper tape or to punched cards.

Interpreter

UGC INSTRUMENTS
A DIVISION OF UNITED GAS CORP.
METERCORDER

For further information phone or write:
UGC INSTRUMENTS
P. O. Box 1407
Shreveport, Louisiana
Phone UN 1-4531 — LD 81


Tin-plated, clamp-type terminals accommodate conductors from #6 to 400 MCM, can be replaced with compression terminals.
Sleet hood protects contacts, minimizes icing. Wide-angle entry surfaces guide cartridge into contacts.
Expendable cap, expelled only on high faults, provides accurate pressure relief.
High leverage hook ring operates positive latch.
Fuseholder lift ring securely engages hookstick, aids cartridge removal or replacement.
Upper contacts are silver-plated, self-aligning, self-wiping, have high thermal capacity
Extra-tough fuse tube, lined with top quality de-ionizing fibre for extended life.
Heavy-duty NEMA mounting bracket.
Bird-proofed insulator mounting.
Strong, lightweight, highest quality wet process porcelain insulator.
Box-type cartridge terminal simplifies anchoring of 1, 2, or 3-tailed fuse link leaders.

NEW KEARNEY 200 AMP "HX" CUTOUT

Kearney substation-proved to positively and repeatedly interrupt 12,000 amperes at 7.8 KV... 10,000 amperes at 15 KV

- No "blind" spots... a highly efficient combination of single end venting and expendable cap double venting insures dependable interruption throughout the entire fault range... from low current values to maximum rated capacity of the cutout.
- On low and medium faults, expendable cap remains intact... tube vents only at bottom. Controlled spring loading and long travel of lower hinge toggle whips fuse cable out of cartridge to insure positive low current interruption.
- Expendable cap is expelled only on high faults. Resultant double end expulsion in line with fuse tube relieves gas pressure, equalizes interruption shock forces and prevents damage to cutout or bracket.
- Switchstick-operated positive latch prevents accidental cartridge dropout due to vibration, impact, or magnetic forces.
- Strong, durable, non-ferrous construction for long life, optimum performance. All current-carrying parts copper alloy. Silver-plated contacts. Stainless steel pins and springs.
- Fuseholders accept all conventional button-type links.
- Kearney "HX" Fuse Cutouts are available on single insulator, NEMA station-post, or centerbolt insulator mountings; also in 100 ampere continuous ratings.

Ask your Kearney Sales Representative for full information or write for "HX" Cutout Bulletin

KEARNEY

for better construction... safer maintenance... specify KEARNEY products

JAMES R. KEARNEY CORPORATION

4224-42 Clayton Avenue, St. Louis 10, Missouri

PLANTS AT: ST. LOUIS • FAYETTEVILLE, ARKANSAS • SHENANDOAH, IOWA • CLARINDA, IOWA • GUELPH, ONTARIO, CANADA • ST. THERESE, QUEBEC, CANADA

Radially laminated cores for single phase transformers

By E. H. Stauffer, Project Engineer, Brown Boveri Corp.

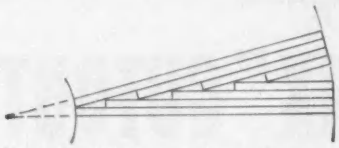
BROWN BOVERI

Brown Boveri's radially laminated cores allow the design of high-rating units with reduced height and weight and greater efficiency . . . to meet rail and highway limitations and to reduce costs.

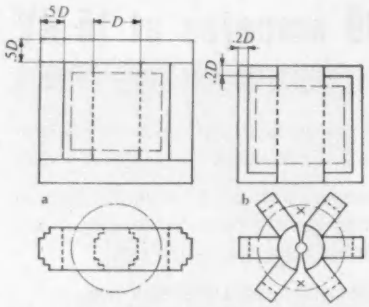
Magnetic flux passes in and out of a transformer core through the edges of the core laminations. Thus, in a parallel laminated core, flux flows only in parallel planes. In a radially laminated core, flux enters from all directions — providing a number of advantages:

Reduced height.

Yoke height is reduced to about 20% of limb diameter. A large single-limb transformer with a 40" diameter radially laminated core, for example, will save up to 5 ft. of building height or shipping clearance as compared to conventional three-limb transformers.



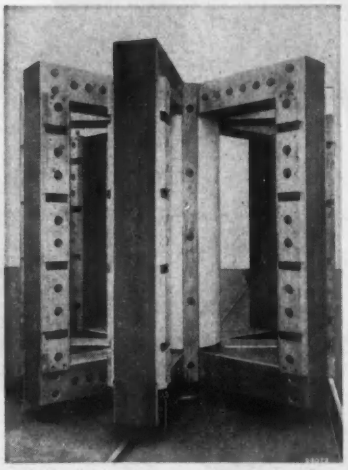
Sector of radially laminated core. Core space utilization is comparable to that of stepped parallel laminations.



Height comparison for large single-phase transformers. a — parallel laminations. b — radial laminations. Empty sectors at x allow room for connections or taps to inner coils.

Lower losses.

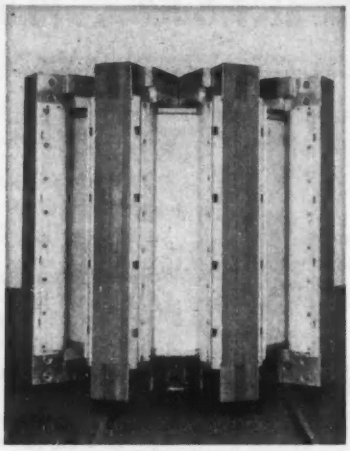
All core laminations face edgewise to the concentrically arranged coils . . . reducing stray losses and eddy currents to a minimum.



Radially laminated core for single phase transformer, before winding.

Lower material costs.

The lower yoke height means considerably less iron is required. The lower, horizontal parts of the yokes also serve as coil supports so that elaborate bases are eliminated. The simple circular tank needs no wall reinforcements, uses a minimum amount of oil.



Radially laminated core for single phase transformer with winding in place.

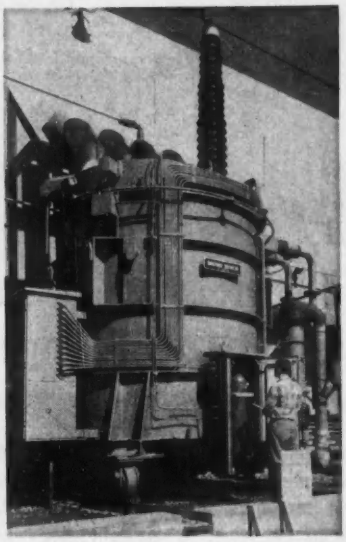
Lower assembly costs.

Butt-jointing of yokes eliminates interleaving of yoke and core laminations, simplifies construction.

Other core construction features:

Special selection and preparation of core sheets and the use of non-magnetic or shielded pressure plates, bolts and screws reduce no-load current and iron losses. Yokes are tied rigidly to the central core with non-magnetic bolts for minimum noise level.

The total capacity of Brown Boveri transformers built with radially laminated cores is now over ten million kva. *None has shown any trace of iron troubles.*



One of 13 Brown Boveri single phase transformers with radially laminated cores at Robert Moses Dam, Massena, N. Y. All are 3-winding type, equipped with forced oil-water heat exchangers and rated 86,000 kva. Six are 115-13.2/13.2 kv, six are 230-13.2/13.2 kv. The spare is reconnectable for either voltage.

NOTE: Brown Boveri's "Splayed Flange Insulation" also reduces transformer size by reducing the distance between windings and the size of the core. This unique insulation is described in another advertisement.

BROWN BOVERI Brown Boveri Corp., Dept. EW-9 19 Rector Street, New York 6, N. Y. Agents in 27 U. S. Cities

Here are some plain facts about Intermediate Class Thorex Dynagap lightning arresters.

Compared to published industry maximums for the most costly heavy-duty Station Class arresters of only two or three years ago, the present Type GP (Intermediate) Thorex averages 35 per cent lower IR discharge voltage . . . a 35-per cent better arrester than money could buy in only 1958. Currently, it comes within just a few per cent of meeting the sharply-revised new industry maximums for heavy-duty Station Class IR discharge voltages.

In low-current, long-duration durability, the Thorex Intermediate arrester exceeds by over three times the present ASA Standard for heavy-duty Station Class.

These arresters cost less than half the price of corresponding Station Class models.

If your protective needs are high, and your budget low, you can buy the most protection per dollar with Thorex Dynagap Type GP arresters. Published information will confirm this if you care to run-down the data. Otherwise, simply install them . . . with confidence.

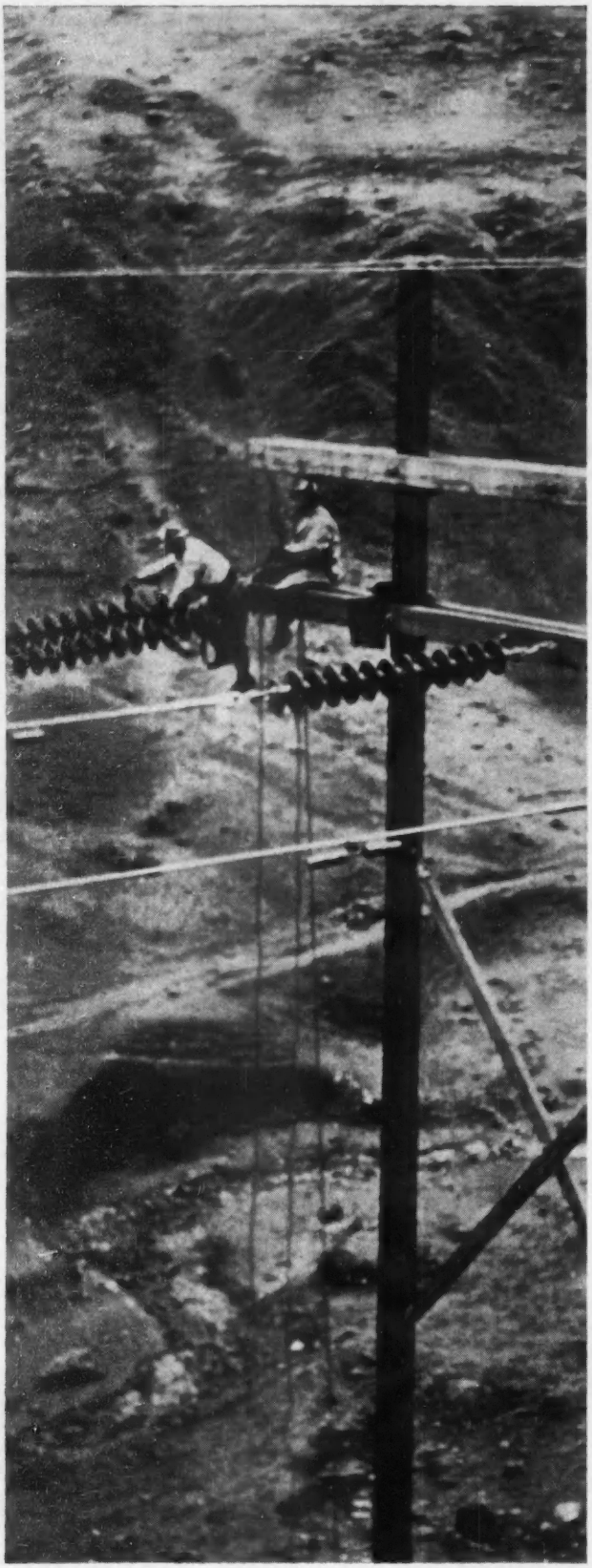
OHIO BRASS COMPANY, MANSFIELD, OHIO

Ohio Brass

HOLAN

PORCELAIN INSULATORS · LINE HARDWARE · CAPACITORS · LIGHTNING ARRESTERS
BUSHINGS · HOLAN TRUCK-MOUNTED POWER DEVICES AND BODIES · BRONZE VALVES

10002-H1



Ebasco experience cuts costs in system planning

Experienced planning is what accounts for EBASCO's success in reducing system costs for electric utilities.

EBASCO specialists can find economical answers to *your* system problems, too—can help *you* reduce costs of distribution and transmission by providing long-range or interim planning to facilitate economical design and construction programs.

EBASCO engineers have contributed to the construction and improvement of facilities for many of the world's leading electric utilities.

No problem in the industry is too knotty for the EBASCO engineer. He's an expert in every phase . . . method, equipment, construction, and operation.

In what area is *your* problem?—Maintenance? Replacement? Expansion?

Our brochures describe EBASCO's services and how they may be of use to you. For copies, write Ebasco Services Incorporated, Dept. M, Two Rector Street, New York 6, N. Y.

ENGINEERS · CONSTRUCTORS
EBASCO
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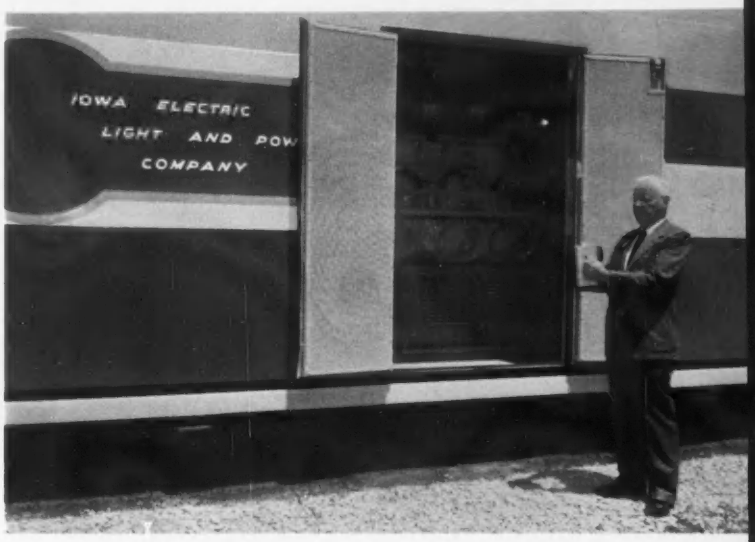
"Why make a big thing out of a 2000 KW plant?"



Remarks made by Sutherland Dows, President, Iowa Electric Light & Power Company, at plant dedication, Ames, Iowa.

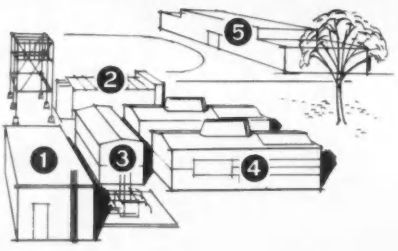
"Today we are dedicating this 2000 KW Electro-Motive peaking and stand-by plant to serve the new National Animal Disease Laboratory here at Ames. Surely the addition of this Electro-Motive unit is not a very big item in a system of our size. So . . . why make a big thing out of a 2000 KW plant?

"The reason it is receiving such attention is because of the unusual circumstances which prompted its design and installation, and the unusual type of service it will render under very special circumstances. Many things are being done here for the first time.

"Due to the type of experimentation to be carried on in this new animal disease laboratory, the facility had to be *guaranteed a practically continuous supply of electricity*. Although we have a multiple source feed at this point, no one can guarantee the uninterrupted operation of transmission lines in the kind of weather that Iowa occasionally gives us.

"We have operated two Electro-Motive peaking plants at Guthrie Center for the last four years. And, their proven efficiency and reliability for our kind of peaking service convinced us that a new Electro-Motive dual-fuel plant was the answer to our problem here at Ames. So, we have located this new plant here at the laboratory where it is available for system peaking and for almost instantaneous service in the case of line outage."

This Advertisement Explains How
Electro-Motive serves Iowa Electric Light and Power ▶



1. Utility fuel and auxiliary control house for laboratory
2. Transformer
3. Peaking plant control component
4. Peaking plant generators
5. Animal Disease Laboratory

This Electro-Motive plant supplies both peaking and stand-by power

Iowa Electric Light and Power's new installation demonstrates the remarkable flexibility of the Electro-Motive dual-fuel plant . . . a standard unit designed to meet a wide range of utility operating conditions.

The unit fulfills unusually stringent requirements of automatic area protection . . . it also operates as a remote-control peaking plant . . . it qualifies as system reserve and as generation credit in the area pool.

Here are some of the details of this installation:

Automatic Dead Load Pick Up

The 2000 KW capacity of the Electro-Motive plant is adequate to provide the non-interruptable power requirements of the laboratory. In addition, provision for automatic dead load pick up is provided through a unique automatic control system. Although the new animal disease laboratory is served by two separate transmission lines, the Electro-Motive plant is designed to provide additional power supply protection under any of these contingencies: (1) If a line outage occurs and attempts to reclose it fail, an automatic signal starts the Electro-Motive plant and brings it up to full speed, no load; (2) Should simultaneous attempts to tie in the second transmission line fail, another automatic signal puts the plant on load; (3) If either transmission line holds, the Electro-Motive plant shuts down automatically after a three-minute running period; (4) If an outage occurs during peaking service, the plant automatically drops out and follows the automatic sequence for dead load pick up.

When either line is restored, the plant automatically resynchronizes with the utility system and is ready for peaking.

Remote Control Operation

The Electro-Motive plant will normally supply 2000 KW peaking power five days a week. In this task, the plant is operated by remote control from Boone, Iowa, 20 miles distant. On signal, the unattended plant starts, synchronizes and goes on line in less than two minutes. Operation from start to stop is completely automatic.

Dual-fuel Operation

Dual-fuel operation was selected for this application because of the relatively long daily peaking periods. The dual-fuel modification of the standard Electro-Motive Diesel plant adds to the initial investment cost. But, because of its low heat rate (11,500 BTU/KWH), it can provide the total KWH required for this installation at *a lower cost* per KWH than can be achieved with any other type of peaking equipment.

In case of low gas pressure, or loss of pressure, the plant automatically switches to Diesel fuel and back again when pressure is restored.

Adaptable to Many Functions

The inherent design characteristics of Electro-Motive equipment make it ideally suited for many of your system peaking and reserve requirements. Electro-Motive plants provide:

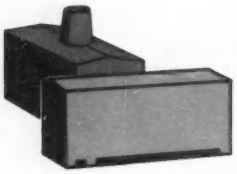
- fast start for spinning reserve
- high starting torque for dead load pick up
- unattended operation for remote peaking service
- portability for simple installation
- freedom from damage to components caused by rapid thermal changes occurring from start to full load.

See additional details on this versatile peaking plant on the reverse side of this page. ▶

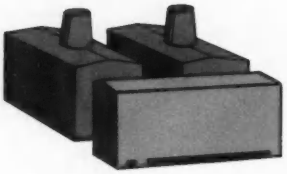
Electro-Motive peaking plants now available in capacities up to 10,000 KW

The Electro-Motive peaking equipment line contains both Diesel and dual-fuel plants in a range of sizes which permit matching the plant to exact requirements for the most economical and efficient operation at the lowest investment. When load growth occurs, additional generating units may be added at low incremental cost to bring the plant up to desired size.

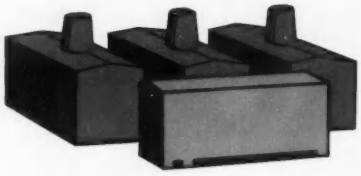
The reliability of Electro-Motive peaking units results from many years of operating experience with the 25,000 GM-567 Diesel engines now in service. This engine is the heart of the peaking plant. Control equipment for the peaking unit has evolved over a period of six years through more than 100 prototype plants. And, behind this proven, reliable plant, Electro-Motive stands as a single-source manufacturer with single-source responsibility for your peaking power requirements. Ask your Electro-Motive representative for complete details.



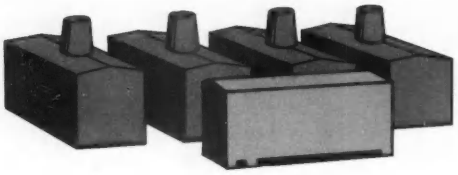
MU-20 2000 KW Diesel
MU-14DF 1000 KW Dual-fuel



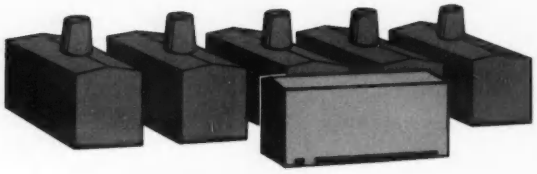
MU-40 4000 KW Diesel
MU-28DF 2000 KW Dual-fuel



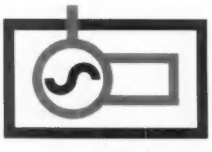
MU-60 6000 KW Diesel
MU-42DF 3000 KW Dual-fuel



MU-80 8000 KW Diesel
MU-56DF 4000 KW Dual-fuel



MU-100 10,000 KW Diesel
MU-70DF 5000 KW Dual-fuel

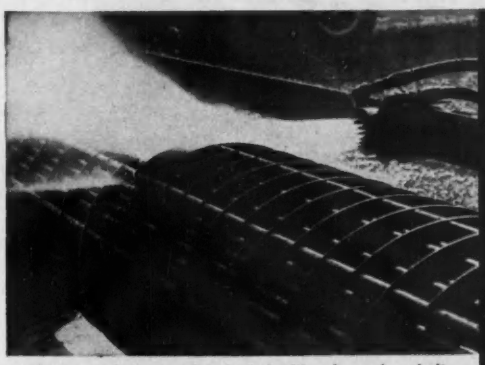


ELECTRO-MOTIVE DIVISION
GENERAL MOTORS La Grange, Illinois

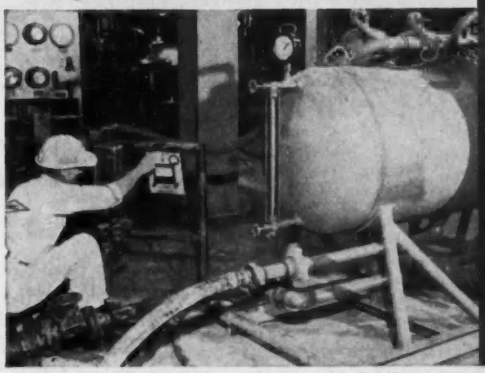
Sales-engineering offices: Chicago, New York, St. Louis, San Francisco

In Canada: General Motors Diesel Limited, London, Ontario

A new mark for a nation-wide cleaning service . . . DOW



Jetting tool cleans tubes fouled with coke and asphalt.



New mobile foam-cleaning equipment cuts cleaning costs.

Cleaning missile lines and components requires tolerances as close as 150 microns.

DOW INDUSTRIAL SERVICE

Industrial Cleaning. Dow Industrial Service, now a separate division of The Dow Chemical Company, offers the only nation-wide chemical cleaning service for virtually all types of industrial processing equipment. This is an expansion of the cleaning service developed over the past 20 years. Dow is currently servicing entire plants as well as doing special cleaning jobs for both large and small companies.

Dow Industrial Service research in industrial chemical cleaning has developed specialized mobile equipment and techniques, some of which are pictured above. These highly efficient techniques are improving plant productivity and reducing equipment downtime in all industries using steam generators, condensers, heat exchangers, towers, water and product lines, water wells and tanks, or similar process equipment.

Product Sales and Service. The sale of specialized chemical products, scientifically formulated to be of use in specific industrial processes and to give the necessary technical service in their use, is the job of Product Sales and Service. Purifloc* N17 is an outstanding new flocculant cleared by USPHS for use in potable water.

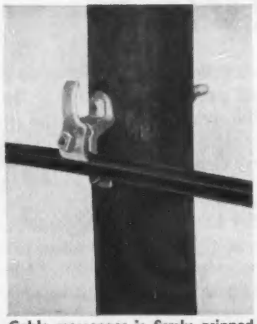
Laboratory Service. Because of the rapid development of chemical products for the municipal and industrial waste and water treatment areas, Dow Industrial Service will take on the service-selling of those products. Also, a consulting laboratory service for municipal and industrial waste and water treatment is provided.

You'll find Dow Industrial Service offices and stations with specialized cleaning equipment and experienced personnel in all major industrial areas. For more information, write to Dow Industrial Service, 20575 Center Ridge Road, Cleveland 16, Ohio. *TRADEMARK

DOW INDUSTRIAL SERVICE DOW *Division of THE DOW CHEMICAL COMPANY*

SUPERIOR I.M. CABLE

Needs No Separate Messenger!



Cable messenger is firmly gripped between jaws of Tangent Support

Supported Exchange Type Cable Installs up to 4 times FASTER...

When you install SUPERIOR I.M. Cable, the need for spinning or supporting the cable to a separate messenger is completely eliminated!

Choose the core construction you need with color-coded plastic insulated conductors and longitudinally applied corrugated aluminum or copper shielding over the core tape . . . sizes 6, 12, 18, 25, 50, 75 and 100 pairs in 24, 22 and 19 gauge soft-drawn copper. Cable exceeds current industry specifications.

The messenger, size 7/32", 19 galvanized strands, is an integral part of the cable jacket. Breaking strength is 6300 pounds. Can be gripped, pulled and tensioned using standard techniques.

Install SUPERIOR I.M. Cable, supported exchange type and save time and money!

Write for complete information and prices to

SUPERIOR CABLE

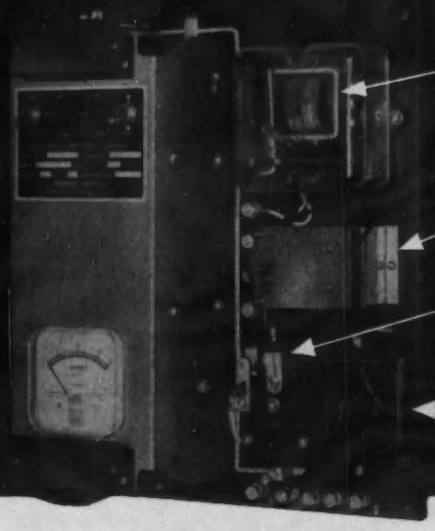
SUPERIOR CABLE CORPORATION, HICKORY, NORTH CAROLINA

ONE OF A SERIES: ASCO Complete Emergency Control Systems Put Standby Power in Action—FAST

Industrial Type Construction Throughout

Unit Chassis Type Charger

- Choice of 2 or 3 input voltages provided by tapped transformer
- Charging current indicated by 0-20 amp. ammeter
- Charger components protected by input and output fuses
- On-Off input toggle switch
- Momentary test toggle switch



Temperature compensated Battery Voltage Sensing Relay with dust proof cover

Field-proven, long-life A-C Motor Driven Timer

Industrial type Battery Charging Contactor with silver-gold low-resistance contacts

Selective Time Equalizer Switch provides equalization of cell charge

NEW ASCO® BATTERY CHARGER KEEPS STANDBY POWER PLANT BATTERIES FULLY CHARGED...AUTOMATICALLY

New ASCO Battery Chargers automatically keep engine starting batteries fully charged; no more weak batteries to prevent starting in an emergency. Maintenance time is minimized; the operator merely maintains the proper water level.

In Operation: while engine is stopped the battery is checked automatically once each hour. Full rate charge is applied (if required) until battery is in fully charged condition; at that time, the charger disconnects automatically. Plus Features – charger is automatically disconnected during cranking period; starts recharge immediately after!

New automatic battery charger also protects against overcharging, assures longer battery life. Electrical Characteristics: Input to 600 V. A-C, output: 6-12-24-32 V. D-C; charging rate, 6.0 amperes.

For complete information write for Bulletin 237.

Now you can select an ASCO Battery Charger to meet any of your requirements. Other battery chargers in the comprehensive ASCO line:

Non-automatic ASCO Battery Chargers: available with input voltages to 600 V. A-C; output: 6-12-24-32-36 V. D-C. Specifically designed for heavy-duty industrial use, they feature selenium rectifiers and continuous adjustment charging rate from 0.05 to 2.0 amps.

For complete information write for Bulletin 203.

ASCO Trickle Rate Chargers feature continuous adjustment range of 50 to 200 milliamperes; input 120 volts A-C; output 6, 12, 24, and 32 volts D-C.

For complete information write for Bulletin 236.

All ASCO Battery Chargers are designed to industrial control standards.

Dependable control by ASCO...

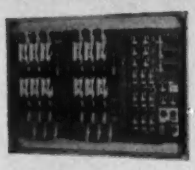
ASCO Electromagnetic Control

Automatic Switch Co. 50-P HANOVER RD., FLORHAM PARK, N. J., FRONTIER 7-4600

AUTOMATIC TRANSFER SWITCHES • SOLENOID VALVES • ELECTROMAGNETIC CONTROL

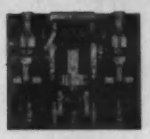
ASCO

ASCO CONTROL SYSTEM COMPONENTS:



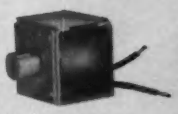
Automatic Transfer Switches, *for all classes of load to 750 volts AC-DC, transfer connected load to standby power when failure or substantial reduction of normal power occurs. Return load automatically when full power is restored—in sizes from 10 to 2000 amps. Write for Catalog 57-S1.*

Automatic Engine Starting Controls *provide fully automatic starting and stopping of diesel or gas engine driven generating sets. Write for Catalog 57-S6.*



Load Demand Controls *automatically initiate starting of engine when load is applied; stop it when load is removed. Write for Catalog 57-S6.*

Solenoid Valves *for air starting applications; for controlling the flow of cooling water; fuel oil and other liquids and gases. Write for Catalog 292.*



Solenoids *for fuel control devices, operating shutters for engine cooling, and other electric plant applications. Write for Catalog 57-S5.*

no gall at all... with solid coin silver contacts

Now you can count on high pressure solid silver to silver contacts for air disconnect switches with no galling action at the contact areas. Federal Pacific—leader in the design and manufacture of power switches for over 50 years—proudly announces this major improvement: Integral, true coin silver inserts that are harder than hard-drawn copper . . . insure longer, maintenance-free life . . . eliminate the need for multiple parallel contacts . . . permit heavy wiping action for thorough cleaning. Immediately available in group operated switches, vertical break type TG 7.5-330 KV and center side break type YVH 46-230 KV. Write for Bulletin 6900, Dept. FP-6, Federal Pacific Electric Company, Newark 1, N. J.

FEDERAL PACIFIC ELECTRIC COMPANY

FP⚡E

growth through creative energy

Plate steel spiral scroll case during installation at the Prospect powerhouse.

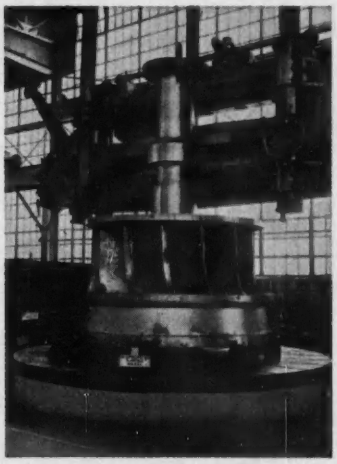
Niagara-Mohawk picks a Leffel Turbine for new Prospect powerhouse

Prospect powerhouse, Niagara-Mohawk's 87th hydroelectric generating plant.

A Leffel spiral case, vertical shaft turbine is the heart of the Prospect Development powerhouse recently completed by the Niagara-Mohawk Power Corporation near Utica, New York. This turbine is rated at 23,900 H.P. at 180 R.P.M. under a 135 foot net head.

Prime factors in Niagara-Mohawk's selection of a Leffel turbine for Prospect were Leffel's long experience in water power development and the proven ability of Leffel turbines to operate at high efficiency year-after-year with absolute reliability.

Take advantage of Leffel's water power know-how on your next project. Nearly a century of experience stands behind every Leffel turbine . . . and this experience is available to you without obligation. Just write, outlining your requirements.



Runner and shaft for the Prospect turbine on Leffel's 24' vertical boring mill.

1112-E

FOUNDED IN 1862

THE JAMES LEFFEL & CO.

DEPARTMENT M • SPRINGFIELD, OHIO

MORE EFFICIENT HYDRAULIC POWER FOR 98 YEARS

Save money with Today's Best Buy in 2-Way Radio—

RCA transistorized "LD"!

Compare the "LD" and you'll see why it is "today's best buy in 2-way radio." Priced lower than competitive units, the RCA Low Drain mobile radio combines both tube and transistor circuitry to deliver optimum performance with minimum maintenance. You get longer vehicle battery life, too, because the "LD" is miserly on battery drain . . . your battery stays charged even after the engine is turned off and radio operated for a considerable time.

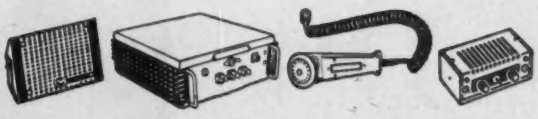
No other 2-way radio out-performs the all-new "LD"! You get best signal reception—a booming 5 watts of audio enables your driver to hear messages even when away from his vehicle. And the "LD" is built to take it, thanks to Security Sealed Circuits that protect against vibration damage. The "LD" gives you more profitable on-air time, day-in, day-out.

Your RCA representative will be glad to explain the many other reasons why RCA "Low Drain" equipment is today's best buy in 2-way radio. Or mail coupon for complete descriptive literature.

RCA

The Most Trusted Name in Electronics

® RADIO CORPORATION OF AMERICA



RADIO CORPORATION OF AMERICA
Communications Products, Dept. LC-45
24 Murdock Street, Canonsburg, Pa.

☐ Please send me FREE literature on the new RCA Transistorized Mobile Radio.

☐ Have RCA Communications Specialist contact me and explain why this is today's best value in 2-way radio.

NAME _____ TITLE _____

COMPANY _____

TYPE OF BUSINESS _____

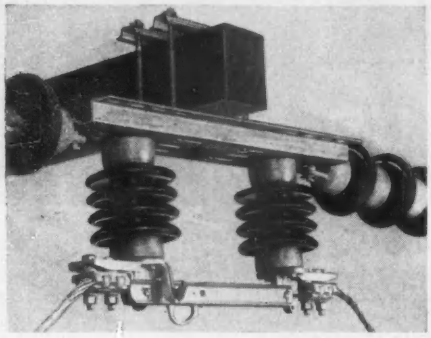
ADDRESS _____ PHONE _____

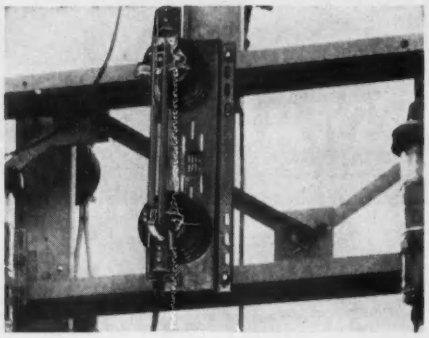
CITY _____ ZONE _____ STATE _____

The New DS-DSB . . .
most adaptable switch of its type

I-T-E's new contribution to low-cost hook-operated switching

From base to blade, this rugged new switch provides unmatched adaptability to meet all of your specific requirements . . . at a new low cost. The DS-DSB makes no compromise with quality. Options in the selection of key components let you buy only as much switch as you need . . . nothing more, nothing less! It meets all NEMA electrical and mechanical requirements for hook-operated switching from 7.2 to 23 kv, 400 and 600 amperes. Check out this inexpensive "full performance" switch carefully and see for yourself!





The base is universal, providing double-crossarm mounting as shown on the facing page; or a rigid, double-bracket, single-arm mounting as shown at left above; or through-bolt mounting on steel (as shown at right above), or wood.

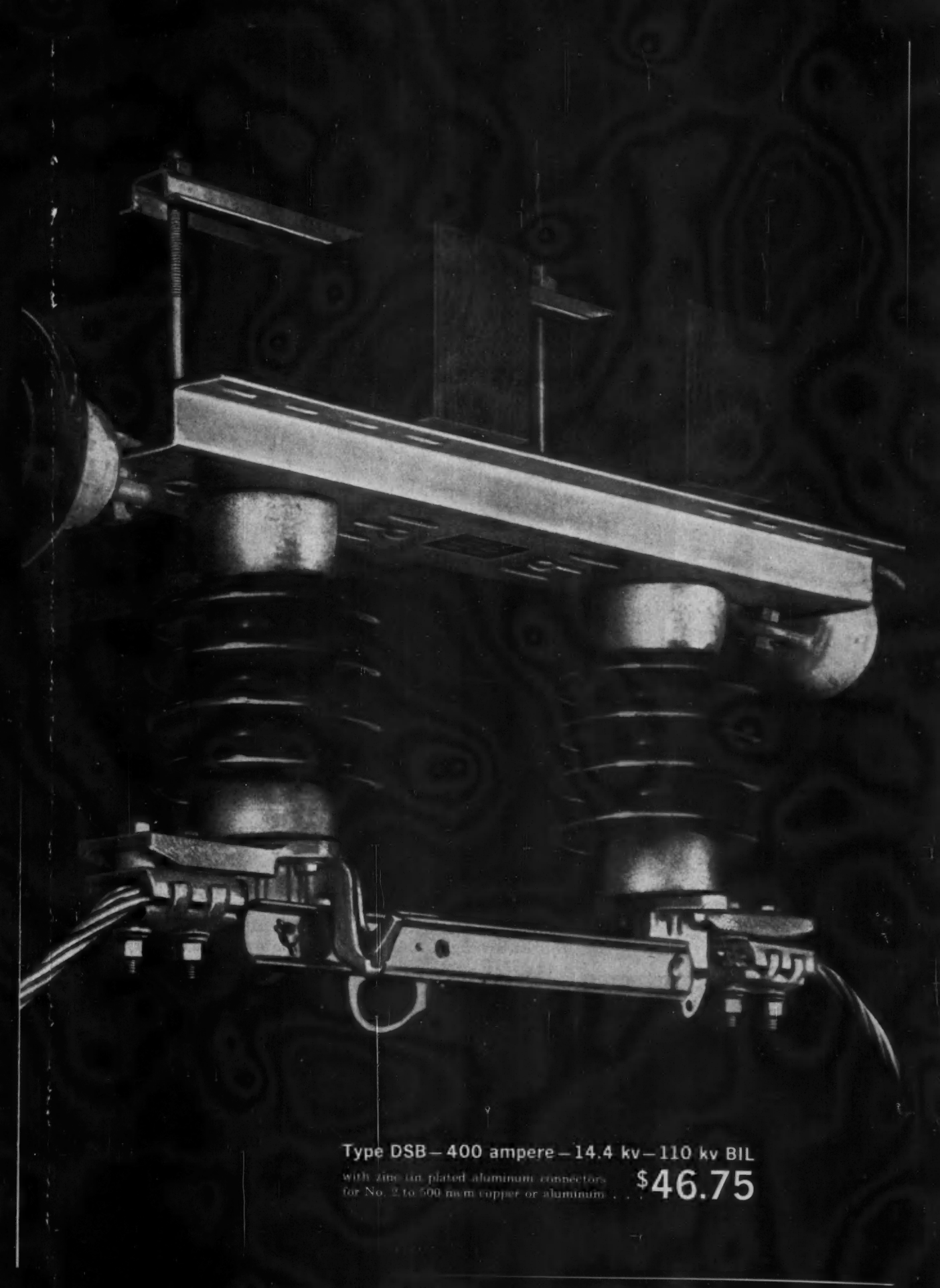
Loadbreak tool (S&C Loadbuster) operation is optional, with hooks to convert from DS to DSB shipped with each switch when specified.

The full line of these new, low-cost, Type D-insulated, NEMA rated switches are available from I-T-E warehouse stocks. All of the standard connectors, for aluminum and/or copper, are stocked with the switches.

IN ITS VOLTAGE AND CURRENT RANGE, THE DS OFFERS MAXIMUM VALUE AND PROVEN PERFORMANCE

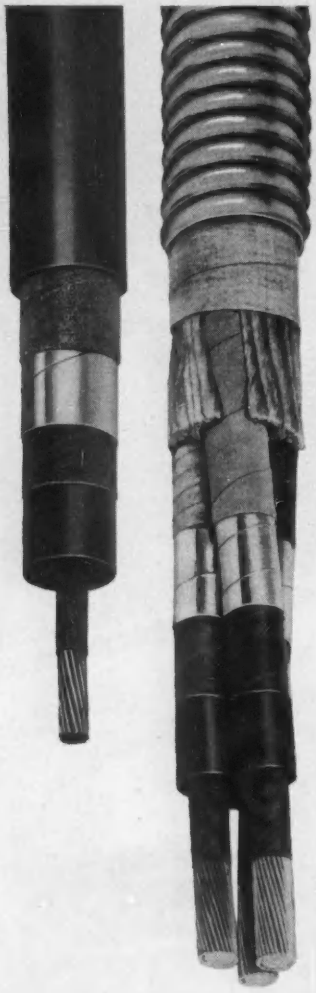
Get complete information. Ask your local I-T-E representative for a demonstration, and a copy of Bulletin 1030A—or write for information to Greensburg Division, I-T-E Circuit Breaker Co., Greensburg, Pa.

I-T-E CIRCUIT BREAKER COMPANY



Type DSB – 400 ampere – 14.4 kv – 110 kv BIL

with zinc tin plated aluminum connectors for No. 2 to 500 mcm copper or aluminum . . . $46.75



how good should power cable be

...*for long term stability?*

It isn't enough to meet or barely surpass specifications—not when it is possible to build maximum performance into power cable—as Circle does. Take, for example, the IPCEA-NEMA 60 cycle water absorption test.

Circlesheath® Type RR Power Cable Performance

In the IPCEA-NEMA "Accelerated Water Absorption Tests," Section 6.9, a sample of power cable is immersed in 50°C water for a period of 14 days during and after which time specific inductive capacity and stability factor are measured.

Not only does Circle butyl-insulated power cable far surpass all minimum specifications after 14 days immersion—*but continues to do so after one year and eight months of continuous immersion. And the test is still going on!*

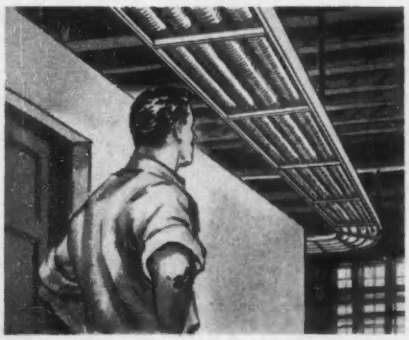
Date of original immersion: September 1958 Date of last test: April 1960

CABLE DESCRIPTION: 15KV, UNGROUNDED, SHIELDED	CIRCLESHEATH® CHANGE SIC	PERFORMANCE STABILITY FACTOR
700,000CM	4.3%	.6%
300,000CM	3.9%	.5%
300,000CM	3.6%	.4%

IPCEA-NEMA Requirements: Change SIC 1 to 14 days: 5% max.—stability factor after 14 days: 1% max.

The manufacture of high-reliability power cable is no accident. It requires expert knowledge of compounding techniques, absolute quality control—and production men who not only care enough . . . but *know enough* to produce the very best.

Circle CIRCLOC® Interlocked Armored Cable combines flexibility with mechanical protection in one lightweight, economical construction. It trains easily over obstructions; is ideal for future plant expansion. Available in galvanized steel, bronze or aluminum armor—from 600 to 15,000 volts.



CIRCLE WIRE & CABLE
a subsidiary of
CERRO DE PASCO CORPORATION

RUBBER COVERED WIRE & CABLE • VARNISHED CAMBRIC CABLE •
PLASTIC INSULATED CABLE • NEOPRENE SHEATHED CABLE • CIRTUBE® EMT

Of The Nation's Foremost Electric Utilities Protect Equipment With SUBOX Paints

For over 35 years Subox paints have been of increasing service to America's electric utility companies. Today they provide dependable corrosion protection for many billions of dollars worth of transmission towers, substations and other equipment. No other paints in the land protect like Subox, because no others are made like Subox. Only Subox contains suboxide of lead, a unique pigment that continues chemically active even after drying. It builds a tough, fibrous coating that withstands the most punishing exposures.

Subox paints are dependable. And they are economical: one or two coats do the work of two or three of ordinary paint, and a Subox application endures for an average of 6 to 8 years.

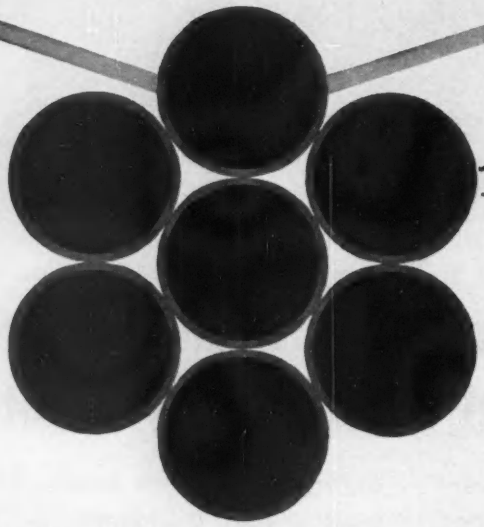
May we discuss your corrosion problems with you?

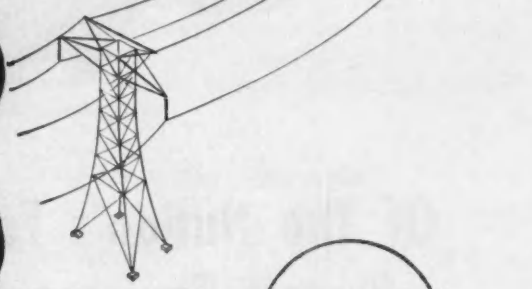
SUBOX PAINTS — Subox Inc. Trade Mark

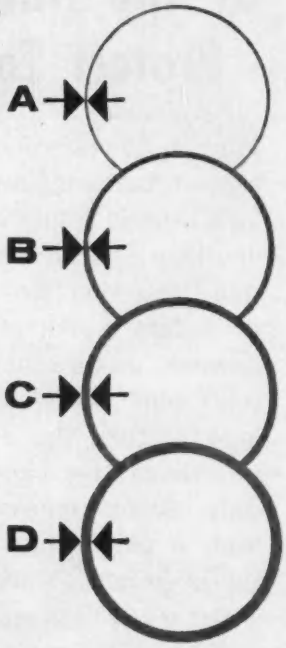
Established 1924 — 3 Fairmount Plant — Hackensack, N. J.

For Long Service...
For Extra Corrosion-Resistance

CHOOSE STRAND WITH A BETHANIZED COATING







The Bethanized coating is not a new type of zinc coating. But it is *proved* . . . especially in utility service where it fights off all kinds of weather . . . in rural, marine, and industrial atmospheres.

Each wire protected by high-purity electrolytic zinc

When you specify Bethanized strand, you get strand that has each wire coated electrolytically with 99.9 per cent pure zinc. The coating is uniform in thickness, and forms a tight bond—yet it is also highly ductile, making it virtually impervious to peeling and cracking.

Choose from 4 coating weights

Bethanized coatings come in four weights: A, B, C, and D. Of these, the D coating (which is furnished in Common, Siemens-Martin, and high strength grades) is heaviest, being four times the weight of the A coating. However, the A coating is adequate for any installation where atmospheric conditions are good. The C coating is three times the weight of A; the B coating is twice the weight of A.

You will find it worthwhile to look into the advantages of Bethlehem Strand. The nearest Bethlehem sales office will gladly give you full details.

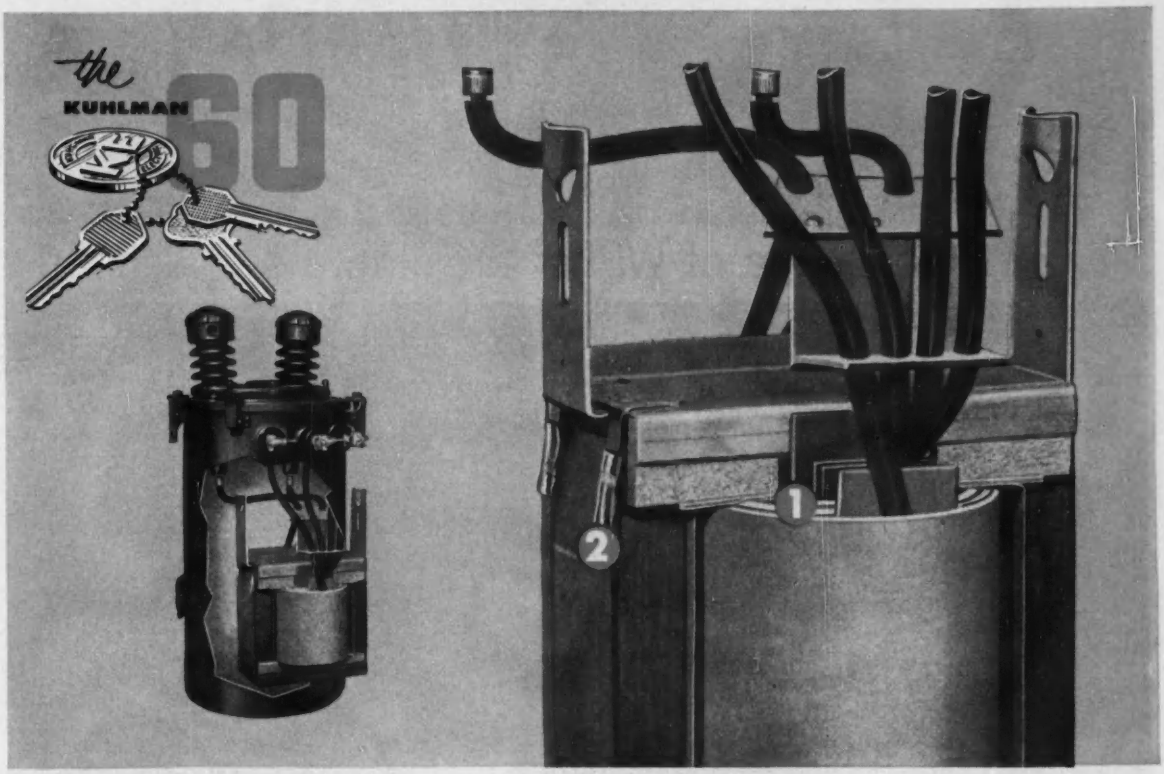
Steel

for strength
... economy
... versatility

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.
Export Sales: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL

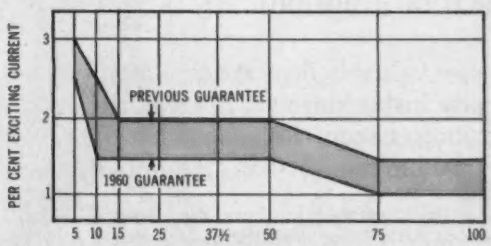


"ALL NEW" Core and Coil Saves Revenue Dollars

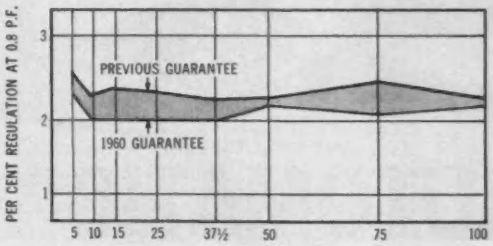
Here are four places to look for new savings in the ALL NEW Kuhlman '60 transformer:

1. *The coil*—mechanically stronger with improved electrical characteristics and an "all new" core that offers more compactness and low copper and core losses. Savings: more transformer for your dollar; less drain per transformer on your system.

2. *The core*—smaller, more efficient with fewer and shorter gaps is designed for minimum local flux concentration and maximum flux flow. Savings: More transformer per pound; more efficiency and operating economy.



3. *Lower guaranteed exciting current*—the result of new Kuhlman '60 efficiency and lower losses—covers all popular ratings as shown above. Savings: Lower exciting current values conserve generating capacity and revenue-producing power.



4. *Better guaranteed regulation*—due to the lower impedance of the new redesigned coil—offers improved regulation in all popular ratings (see above). Savings: The customer gets full power; you get full revenue.

In the face of rising costs, here's one sure way to save revenue dollars. Install ALL NEW Kuhlman '60 transformers. They are more efficient and cost less to operate.

KUHLMAN TRANSFORMERS

KUHLMAN ELECTRIC COMPANY, Birmingham, Mich.

Manufacturers of transformers since 1894

FACTORIES: Bay City, Mich. • Crystal Springs, Miss. • Salinas, Calif.

Meet the challenge of Winter breakdowns in seconds!

REMINGTON RAND KARD-VEYER® FILING UNIT enables the operator to handle customer service calls at the touch of a button!

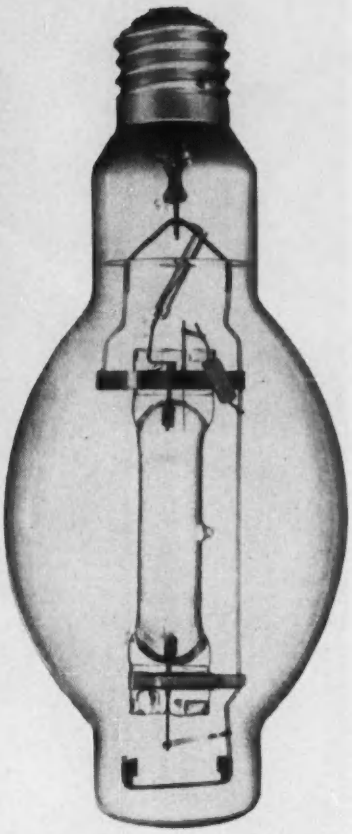
Have your records been keeping pace with the tremendous expansion of utility service in recent years? Are you now "operating blind" – working with uncentralized out-of-date records that can't cope with the massive demand for customer service caused by Winter breakdowns? You can up-date your filing completely . . . be ready for every emergency with Remington Rand Pushbutton Kard-Veyer Units. Kard-Veyer Units enable you to increase reference substantially, and release valuable floor space. Posting is practically instantaneous . . . speeding answers to customer inquiries . . . reducing the time required to issue orders . . . improving service.

For an illustrated brochure describing all Kard-Veyer models write Room 1908, 122 E. 42nd Street, New York 17, N. Y. — specify LBV811.

Remington Rand Systems
DIVISION OF SPERRY RAND CORPORATION

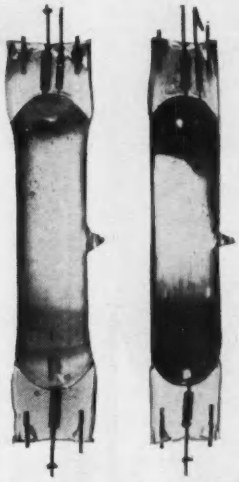
NOW
seamless
round tapered
aluminum
Lighting Standards
by
KERRIGAN
To keep pace with the growing market, we are now manufacturing seamless, round tapered aluminum lighting standards for street, highway and area lighting . . . in addition to our line of steel and aluminum octagonal shafts.
Full data catalog for the new line is now available. Send for your FREE copy NOW!
Address: Dep't. E-9,
KERRIGAN IRON WORKS COMPANY
NASHVILLE, TENNESSEE
SUBSIDIARY OF
ROCKWELL-STANDARD
CORPORATION

6000 USEFUL HOURS EXTRA



New G-E "Bonus Line" Mercury Lamps. 6000 extra hours! That's the bonus your customers get in every 400-watt G-E "Bonus Line" Mercury Lamp . . . and a minimum of 3,000 hours extra in the other wattages. One look at these two light-producing arc tubes and you can see why General Electric "Bonus Line" Mercury Lamps are their best bargain. See how the one from a G-E Lamp stays white? That's because its special electrode doesn't deposit a *black* coating, but a translucent *white* coating that lets the light come through. The result: your customers get as much light at *9,000* hours as ordinary mercury lamps give at *3,000* hours. General Electric "Bonus Line" lamps now available in *all* sizes from 100 to 1,000-watts . . . in all popular shapes and "colors" . . . *at new low prices.*

Men in the know . . . know they get important differences when they specify General Electric Lamps—whether they're mercury, filament or fluorescent. So let your General Electric Lamp distributor explain the important plus you can get in the lamp types you use. General Electric Company, Large Lamp Department, C-033, Nela Park, Cleveland 12, Ohio.

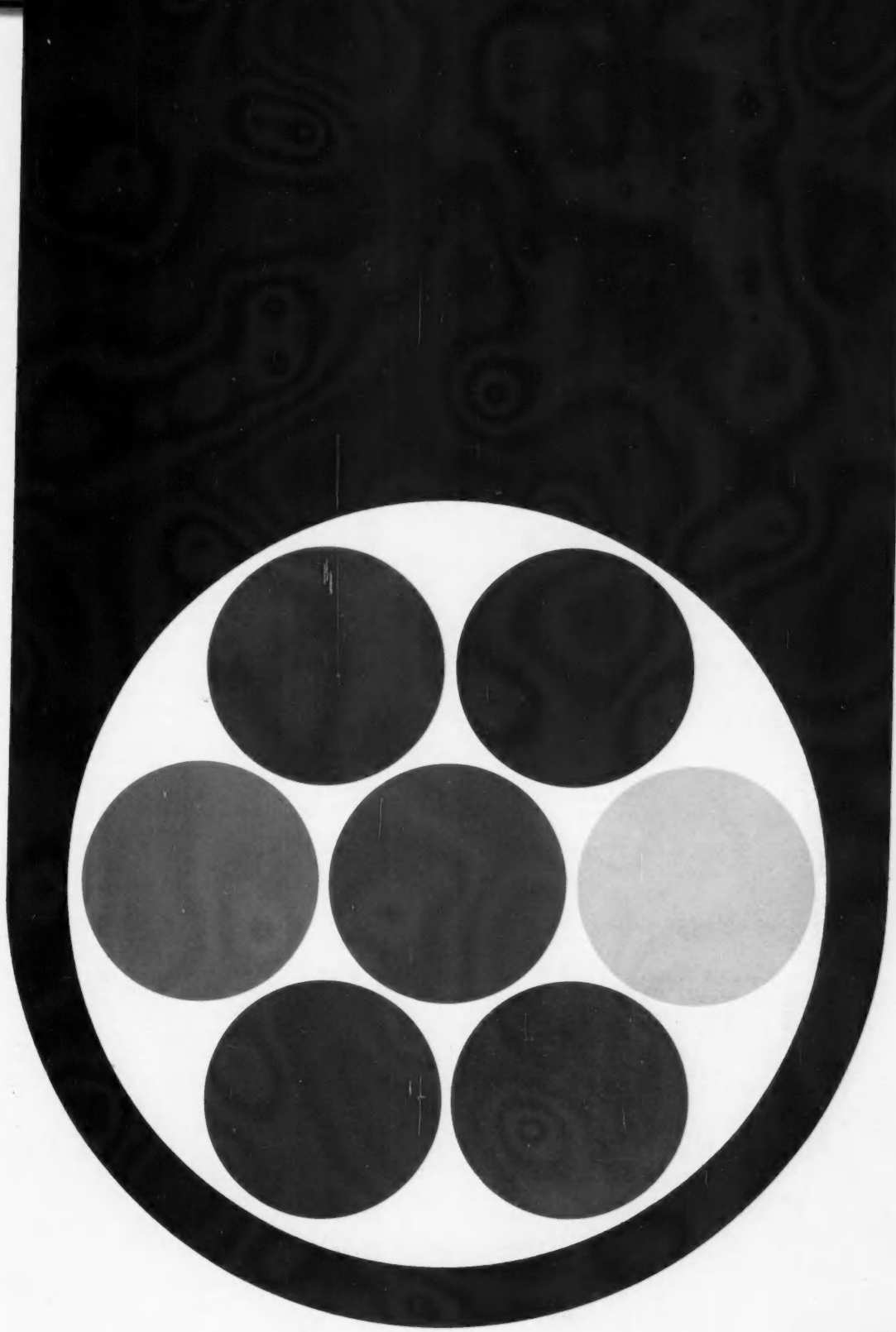


BONUS ARC TUBE AFTER 8000 HRS.

ORDINARY ARC TUBE AFTER 8000 HRS.

Progress Is Our Most Important Product

GENERAL ELECTRIC



IN ELECTRICAL WIRE & CABLE . . . **THE SPARK OF QUALITY IS KAISER WIRE EXPERIENCE**

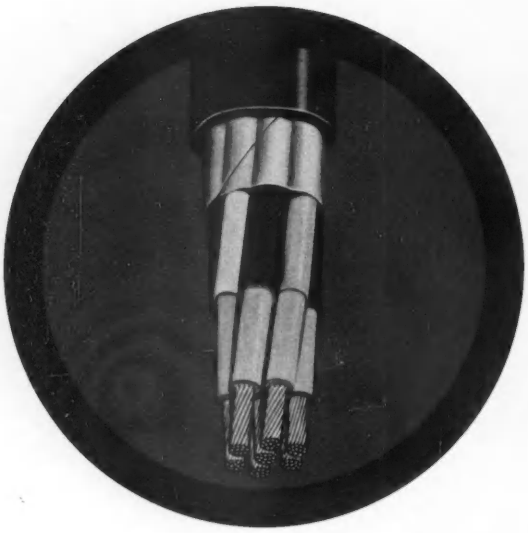
CONTROL CABLE... 28 YEARS OF PERFECT INSULATION SERVICE

KAISER MASTER LAYTEX® CONTROL CABLE has never known a reported insulation failure!...and the introduction of patented Laytex-Resin promises to improve upon this 28-year record of perfection!

Laytex-Resin is the combination of Laytex insulation with a specially-compounded resin layer over the insulation that eliminates the bulk of braided coverings. It brings the following advantages over extruded constructions:

Smaller diameter, to expand service without enlarging ducts...less weight...increased flexibility...proven greater insulation protection against acids, alkalies, flame, fungus, water, oil, ozone and light...uniform protection free of thin spots...can't wick moisture or fray...easier splicing...brighter color coding and longer lengths per reel.

SPECIFY 935-S. ASK FOR KAISER CONTROL CABLE BOOKLET.



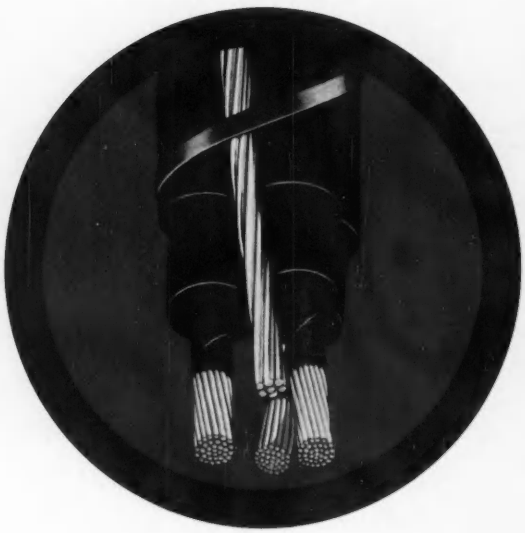
POWER CABLE... 16.4 TIMES MORE OZONE RESISTANCE

KAISER GRIZZLY® POWER CABLE is the only power cable to resist 6000 hours of high ozone shock test—outlasting 9 leading brands tested!

Several samples of each unshielded 5KV cable were placed with a "U" bend resting on a grounded metal plate. A conductor-to-plate potential of 40,000 volts was applied until all cables failed. Four brands failed immediately. The last competitor gave out 432 hours before the first Kaiser cable. Kaiser Grizzly samples went on to last over 6000 hours . . . 16.4 times longer than the test average of best performances . . . 2.4 times the life of the nearest competitor.

The reason: A superior combination of Kaiser insulation and jacketing. In power cables it represents a major victory over the main cause of failure—dielectric breakdown due to ozone.

AVAILABLE IN A WIDE RANGE OF SIZES AND SPECIFICATIONS FOR OVERHEAD AND UNDERGROUND HIGH-VOLTAGE APPLICATIONS.



K/W EHV...1000 MILES OF 345KV...MUCH MORE IN THE FUTURE

KAISER ALUMINUM EHV CONDUCTORS span more than 1000 of the 2500 miles of extra high voltage transmission lines now in service in this country.

As system voltages of 345KV, 460KV and higher become more common, Kaiser offers specialized conductor design, manufacturing, and installation experience.

Kaiser engineers are actively engaged in utility experimental EHV installations...field measurements of corona loss as it affects radio and TV interference . . . bundled conductor and accessory analysis . . . problems of galloping conductors...vibration and tension studies . . . and other research toward better conductor design and installation.

As a result, standard paper expanded core conductors—as well as such designs as hollow core, "I" beam, and tubular expanded core—have been manufactured and subjected to torturous field installation procedures for evaluation.

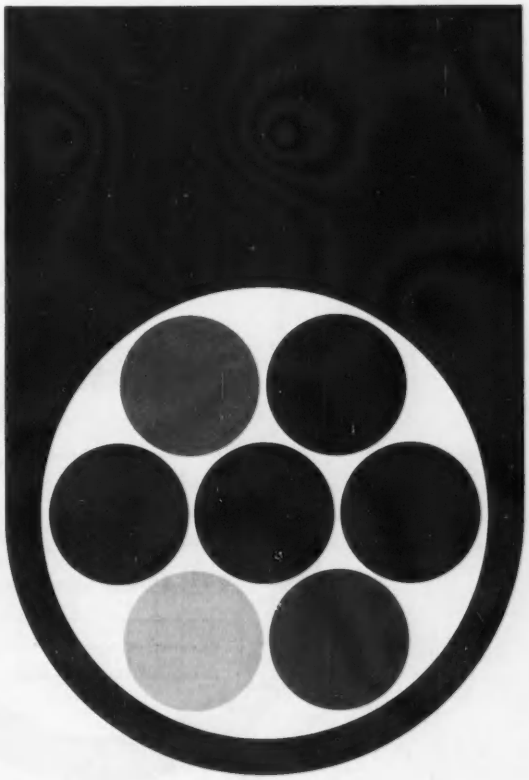
IN ELECTRICAL WIRE & CABLE THE SPARK OF QUALITY IS K/W EXPERIENCE

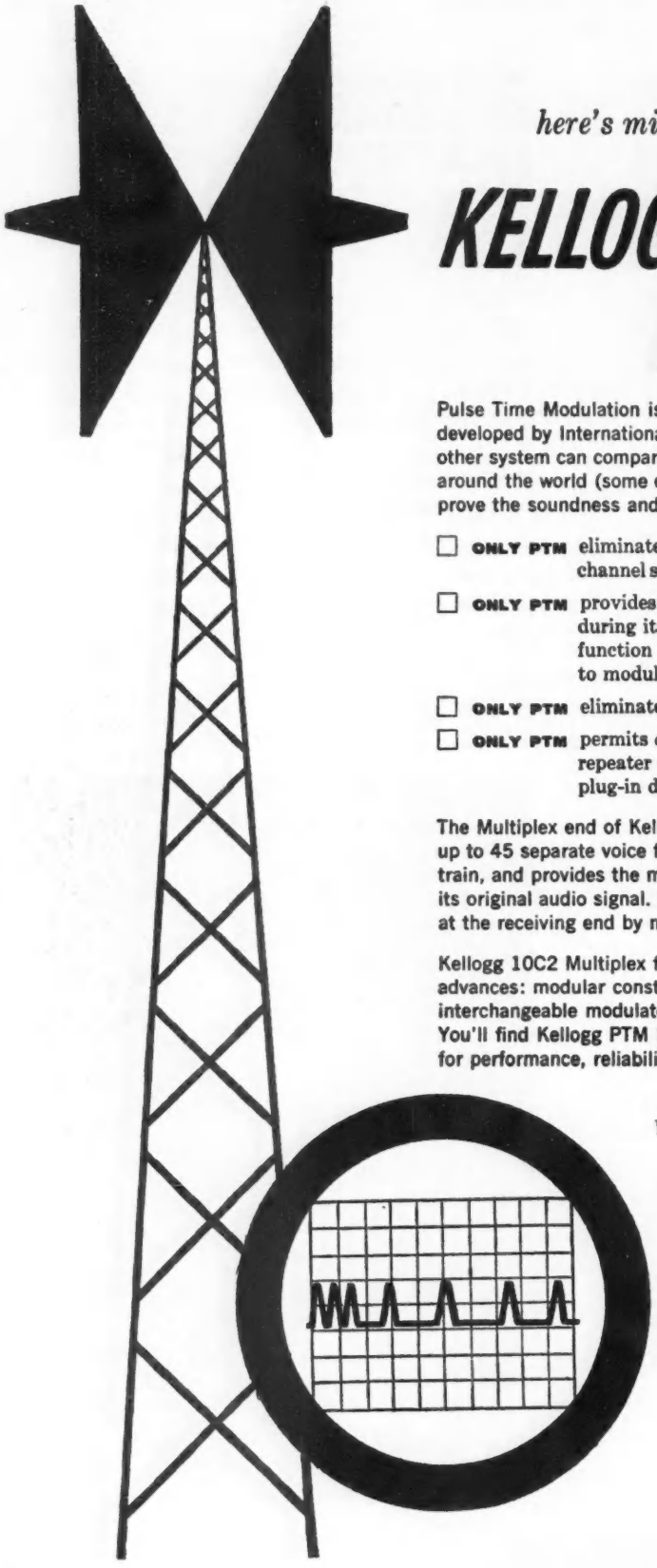
The spark of quality means positive—often dramatic—savings in service for those who will specify Kaiser wire and cable.

Among the world's leading electrical wire and cable producers, only Kaiser is heir to the 70-year experience of a major rubber company in developing insulation and jacketing compounds.

Insulations such as Laytex®, Laytex-Resin, Hydrosec® and Kalzone give greater utility, longer life to a complete range of aluminum or copper conductors. For immediate service in any type of wire or cable, call your K/W Distributor or Kaiser Aluminum & Chemical Sales, Inc., Kaiser Center, 300 Lakeside Drive Oakland 12, California.

KAISER ALUMINUM





here's microwave at its simplest and best!

KELLOGG 10C2 PTM MICROWAVE

Pulse Time Modulation is the foolproof microwave pioneered and developed by International Telephone and Telegraph Corporation. No other system can compare with it in simplicity and reliability. Installations around the world (some dating back to ITT's early systems in the '30's) prove the soundness and reliability of PTM.

- ☐ **ONLY PTM** eliminates complicated tuning or filtering for voice channel separation. All demodulators are interchangeable.
- ☐ **ONLY PTM** provides separate and distinct channels, open only during its own time interval. Therefore S/N is not a function of channel loading; each channel is insensitive to modulation on the other channels.
- ☐ **ONLY PTM** eliminates frequency displacement over the voice channels.
- ☐ **ONLY PTM** permits *any number* of channels to be dropped at a repeater station. Only one additional modulator and one plug-in demodulator are required to drop each channel.

The Multiplex end of Kellogg 10C2 Microwave system can combine up to 45 separate voice frequency channels into a Time-Modulated Pulse train, and provides the means for restoring each of the channels into its original audio signal. Each signal is sorted into its proper channel at the receiving end by means of the distinctive marker pulse it carries.

Kellogg 10C2 Multiplex features the latest and most efficient engineering advances: modular construction, printed circuitry, plug-in channel units, interchangeable modulators and demodulators, and many others. You'll find Kellogg PTM Microwave meets your highest specifications for performance, reliability and engineering design.

Complete technical details will be sent on request. Write to Kellogg's Microwave Division, Box 2725, Raleigh, North Carolina.

KELLOGG
CHICAGO, ILLINOIS
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Kellogg Switchboard and Supply Company, 6650 South Cicero Avenue, Chicago 38, Ill. Communications Division of International Telephone and Telegraph Corporation

DOSSERT UNDERGROUND CONNECTORS...

the versatile line

featuring:

- Fully molded, no factory taped joints.
- Insulated with MYPAR* rubber for higher quality and longer life, or MYPRENE* rubber for higher temperature resistance, and greater resistance to acids and oils.
- Made of high conductivity copper, insuring cool operation.
- Interchangeable with all standard underground connectors and their component parts.
- Made to fit standard compression tools.

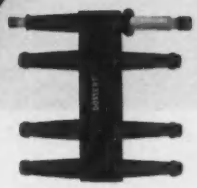
MICON* type MC

MICON COMPONENTS

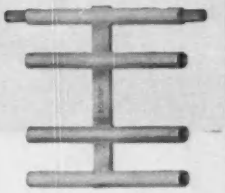
Tapered Compression Sleeve type C

Cable Receptacle type MA

Insulating Sleeve for MICON Outlet type MIS

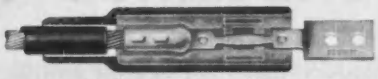


Insulated Crab Connector type CBR



Uninsulated Crab Connector type CBN

MICON Stud Connector type MCBS



Limiter Link Assembly type LLA

Limiter Link Assembly type NLRA

Terminal Lug type DPL

Comp. Coupler type DPC

Comp. Tee Coupler type CRT

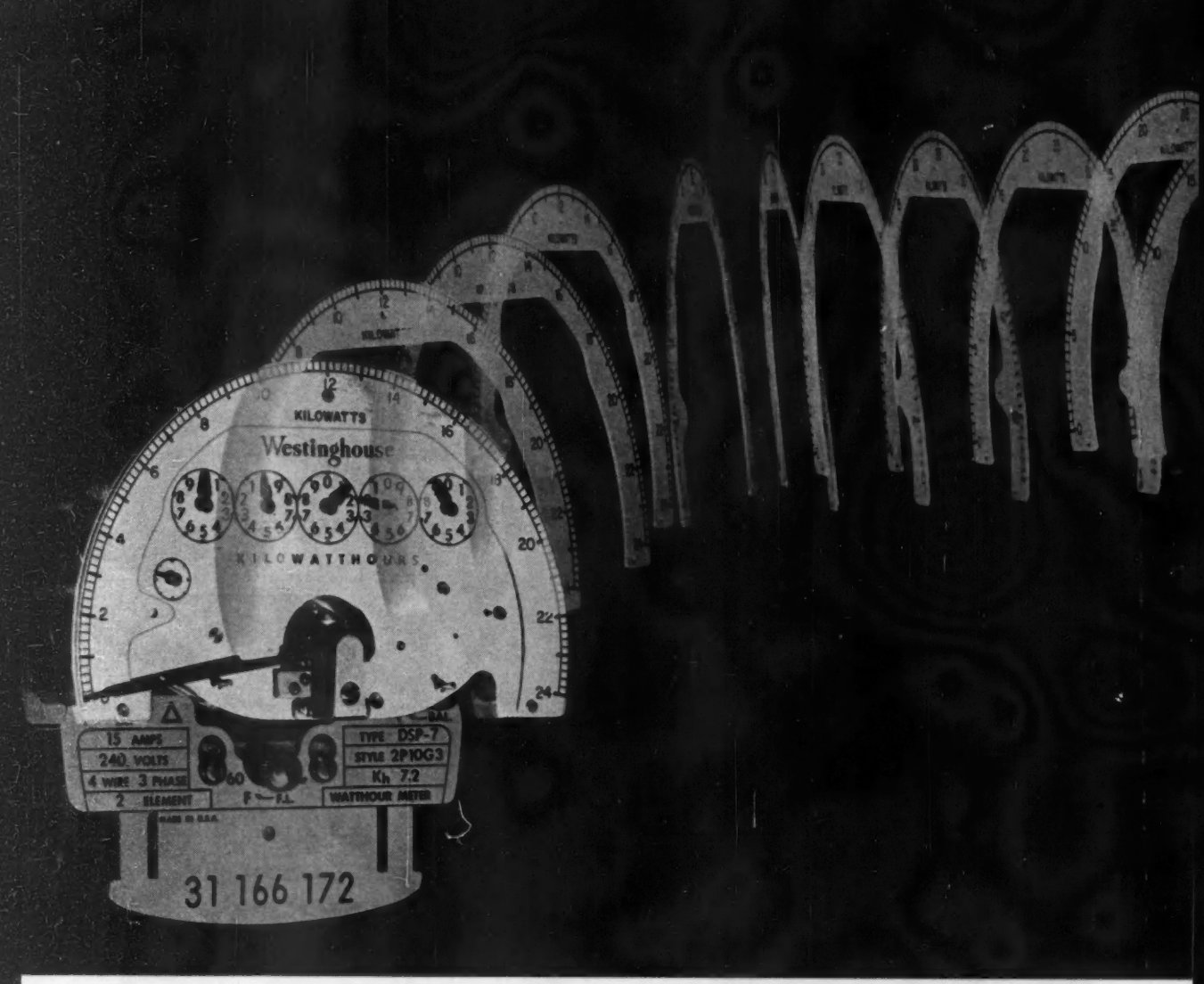
*U.S. Reg. Trade Mark

Write for illustrated catalog. →

50 YEARS OF TECHNICAL KNOW-HOW

DOSSERT MFG. CORP.

249 Huron Street, Brooklyn 22, N. Y.
Representatives in all principal cities



Meterman needs only a screw driver to uprate the Mark I. Just remove the demand scale, turn it over and replace the screws. The installer *can't* make a mistake!

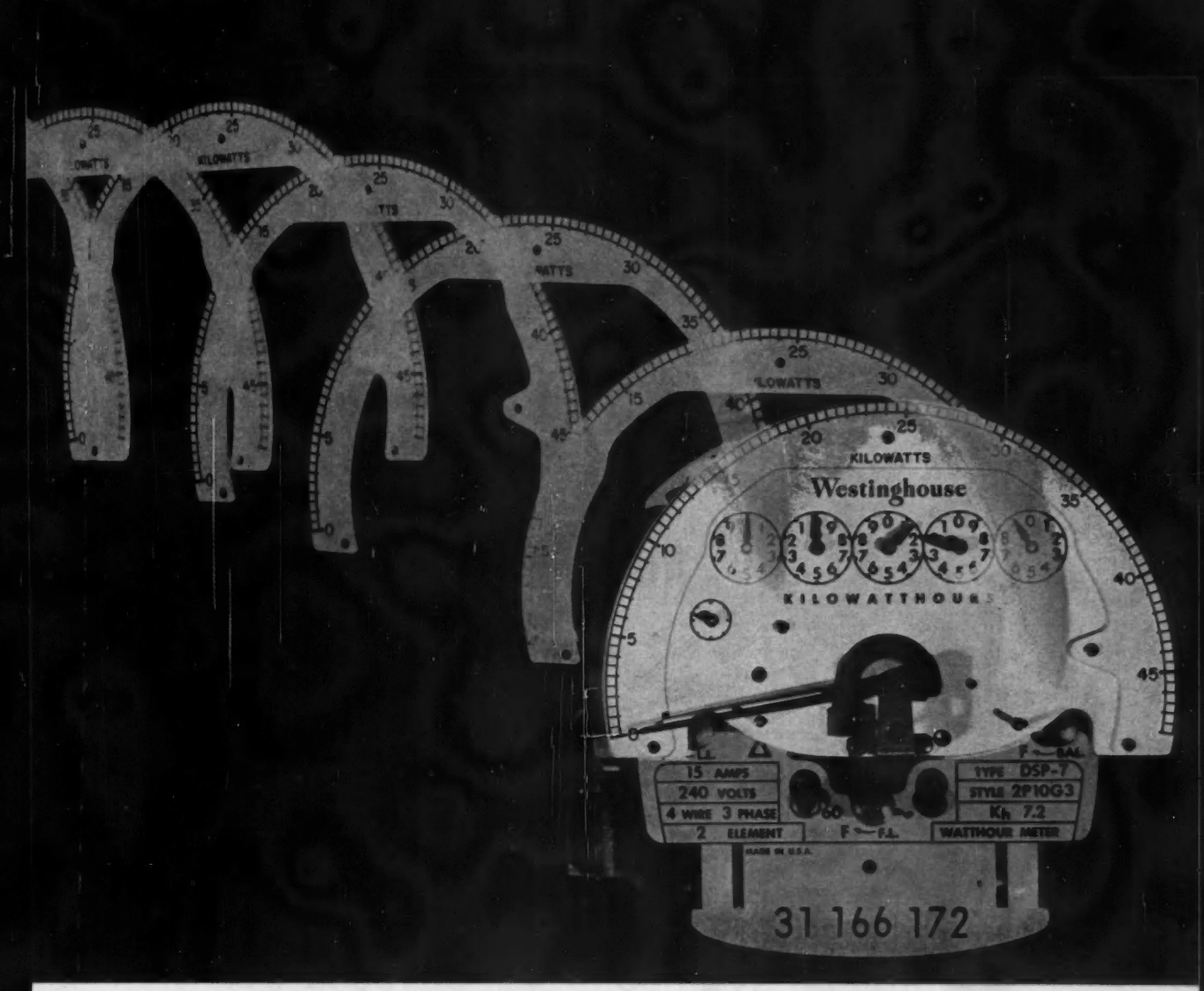
All-New DUAL RANGE "MARK I" Cuts

Exclusive Westinghouse design *doubles* the range of your polyphase meters in mechanical demand applications. With the Mark I type you need only *one* register for *all* your installations . . . regardless of the kwhr capacity range!

Uprate your meter from Class 2 (333⅓% overload capacity) to Class 6 (667% overload) by simply removing the demand scale . . . turning it over and replacing the screws! It's that simple. And, you can't make a mistake . . . gear ratio always matches the scale.

Consider the savings in inventory requirements . . . and ease of making customer change-outs when demand range must be increased.

Open time on the new register is cut to a mere fraction of a second for return of indicating pointer to zero . . . thanks to a new dual pusher design. Big, easy-to-read dials,



Turning the 0-to-48 scale *up* automatically places the small scale tab on the *right* side of the register . . . depressing a plunger that changes the gear ratio.

Mechanical Demand Meter Needs IN HALF!

all in a straight line, eliminate reader errors. Molded coil motor withstands 10,000-volt surges.

Compact, lightweight Mark I is just 2.856 inches deep, weighs in at 11⅞ ounces. Register guards permit face-down inspection without damage to dial pointers. And remember . . . the Mark I carries the exclusive Westinghouse 12-year guarantee!

To get all the facts about the money-saving new Mark I, call your Westinghouse sales engineer. Or write Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pa. You can be sure . . . if it's Westinghouse.

J40533-H

Westinghouse

PROTECT BOTH VITAL AREAS

ANOTHER ASPLUNDH *"FIRST"*—

The Aerial Device That Gives You Complete Insulation From Ground

Once again Asplundh is the *first* to bring you a Safer Aerial Device. No longer need you fear a "HOT TRUCK." Should any part of the moving structure come in contact with an energized conductor the **SPIRALLOY** Upper Boom and **SPIRALLOY** Pylon Insert in the mast prevents the truck from being energized. Don't let an innocent looking vehicle be the cause of a possible tragedy.

"*Your public and your employees are completely protected from this type of hazard at all times.*" This added safeguard to those on the ground is made possible by a special section of **SPIRALLOY** (a non-conductive material) in the pylon mast.

Be sure. Be safe. Insist on the **SPIRALLOY** double ring of safety. Write today for additional information.

ASPLUNDH Chipper Company

501 York Rd., Jenkintown, Pa.

We shoot for the moon every month!

The mean distance from the surface of the earth to the surface of the moon is 233,814 miles. Every month Southwire trucks come close to registering that many miles right here on good old terra firma. Our record so far was set at 229,893 miles in December 1959.

Like some others who are shooting for the moon, we haven't made it yet, but that doesn't keep us from trying. Someday soon we'll do it, and then we'll try for the round trip—467,628 miles!

Far-fetched? We think not. It points up Southwire's unwavering aim to produce more and better wire, and better service.

How does anyone reach the moon unless he shoots for it?

Southwire Company

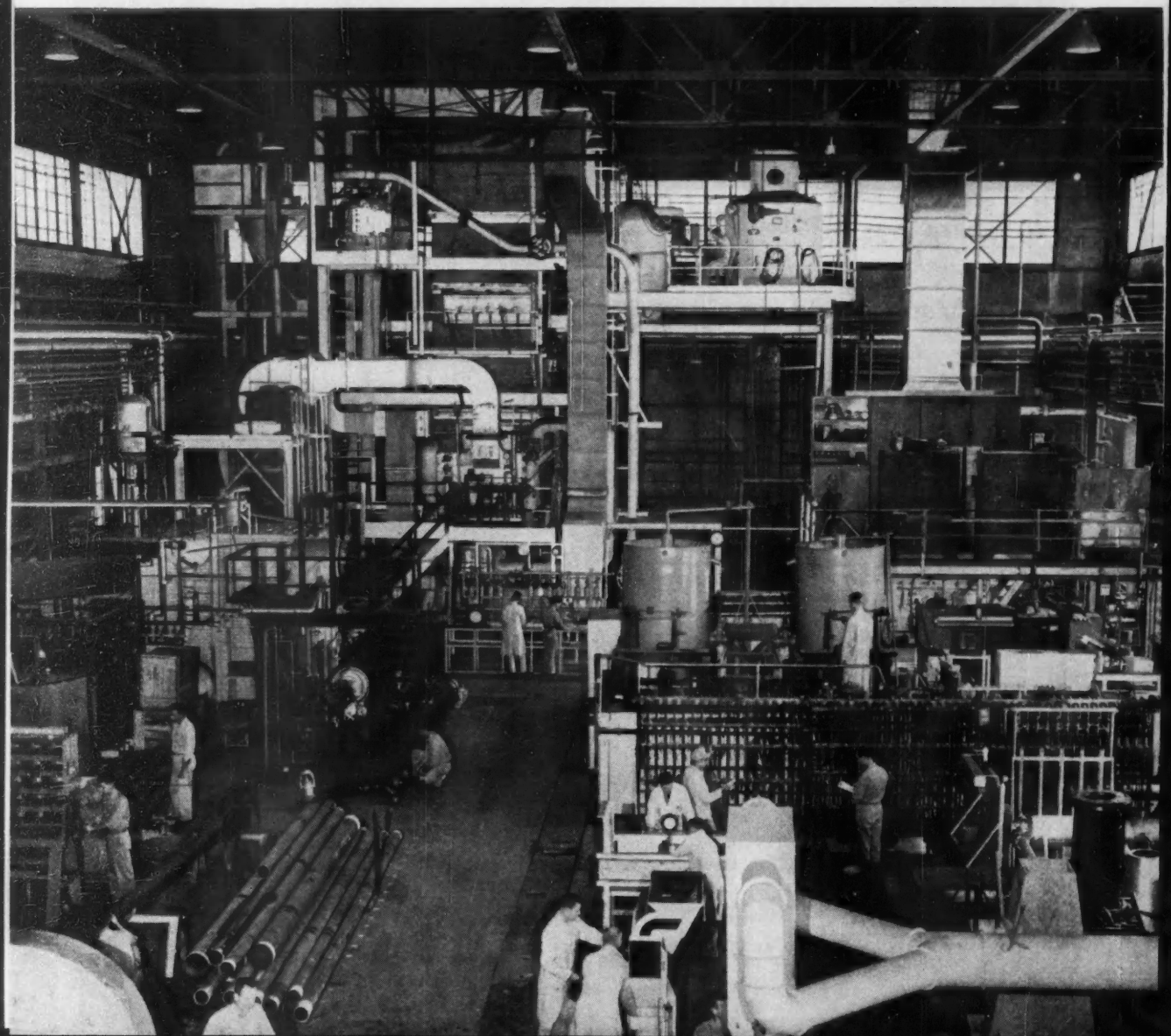
SOUTHWIRE serves the world

Carrollton, Georgia — TErrace 2-6311

- Bare and Weatherproof Copper and Aluminum Line Wire
- Neoprene, Polyethylene, and VWP* (Vinyl) Weatherproof Copper, Aluminum and Triplex
- U.R.C. (DBWP, TBWP) Copper
- Copperweld® Conductors
- Copper and Aluminum Building Wire
- ACSR and All Aluminum Cable
- Galvanized Steel Guy Strand and Static Wire
- Aluminized Steel Guy Strand and Static Wire
- Aluminum Alloy Wire
- Cable Accessories
- NM Sheathed Cable
- ALSO FABRICATORS OF COPPER AND ALUMINUM FOR WIRE AND CABLE MANUFACTURERS

C-E MEASURES THE MERITS OF IDEAS

At Combustion, research guides the design of every product and is at the hub of every area of operation. It is a company policy, the premiums of which are paid for in the time and talents of many skilled and experienced specialists. Their purpose—to find a better way. Their goal—to enable Combustion to provide the most efficient, the most reliable and the most economical steam generating and fuel burning equipment available anywhere.



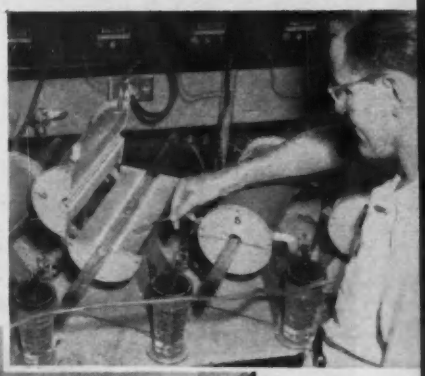
...WITH RESEARCH

Research activities at C-E range from studies of the nuclear characteristics of the atom and the combustion of fossil fuels to the development of methods and materials, the test of metals and the operation of test boilers and nuclear reactor systems. Research, knowledgeable and in depth, is your assurance that C-E products are thoroughly engineered, are dependable and are as modern as tomorrow.

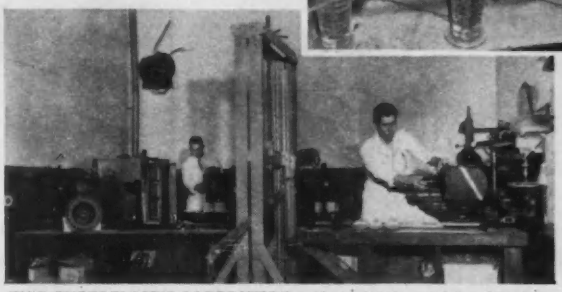
THE KREISINGER DEVELOPMENT LABORATORY is used for the study of fuels and fuel burning systems, water, steam and combustion gases. It contains several test boilers, among them a large Controlled Circulation unit capable of operating at 2000 pounds pressure and a super-critical pressure boiler designed to produce steam at 5000 pounds pressure and 1200°F. This laboratory is one of eight C-E research facilities which, together, total more than four acres under roof.

THIS ADVANCED CRITICAL FACILITY is one of two zero power nuclear reactors used by Combustion for test and experimentation.

THIS METALLURGY LABORATORY tests material strength at high temperatures with these creep-rupture machines.



THIS CHEMISTRY LABORATORY uses a battery of test furnaces to study the causes and effects of corrosive substances in combustion gases.



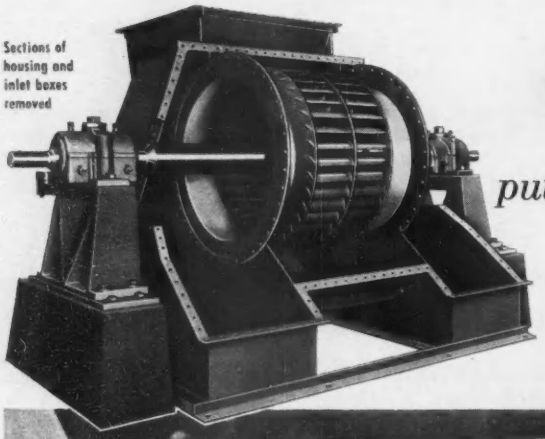
THIS PHOTOELASTIC LABORATORY makes plastic models of various kinds of pressure vessels and loads them to simulate actual operating conditions. Using straining frames and polariscopes, it analyzes the stress patterns locked in the plastic to determine suitability of design.

THE COMPUTER CENTER is used for many kinds of research work. C-E utilizes both digital and analog computer systems.

COMBUSTION ENGINEERING

General Offices: Windsor, Conn. • New York Offices: 200 Madison Ave., New York 16 C-281A

ALL TYPES OF STEAM GENERATING, FUEL BURNING AND RELATED EQUIPMENT; NUCLEAR REACTORS; PAPER MILL EQUIPMENT; PULVERIZERS; FLASH DRYING SYSTEMS; PRESSURE VESSELS; SOIL PIPE.

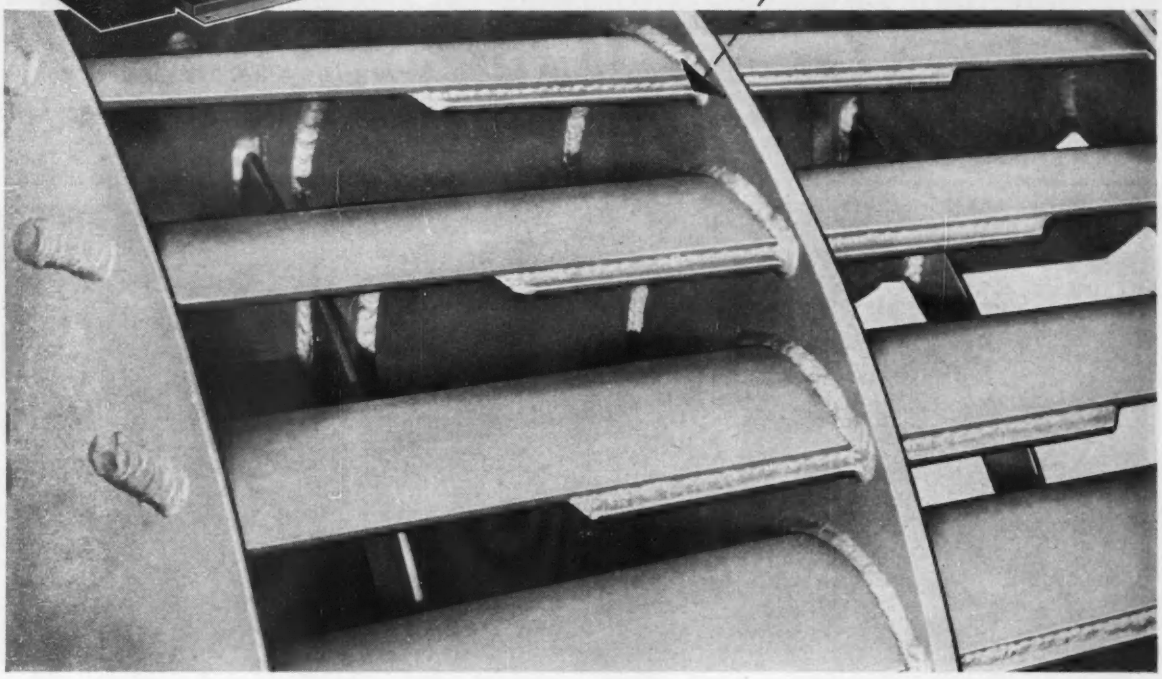


Sections of housing and inlet boxes removed

CLARAGE

puts wearing plates where they belong

on the face of the blades



DON'T SETTLE FOR LESS! Clarage makes sure you get *extra* service life on those punishing induced draft applications.

The Type DN Dynacurve fan, when equipped with wearing plates, has these abrasion-resisting steel plates welded to the *face* of the wheel blades. A distinguishing Clarage feature that guarantees you less maintenance, longer operation! But that's not all.

You get other advantages, and more, with Clarage Dynacurve fans: Minimum floor space and height requirements. Rugged wheel of 36 radially deep, aerodynamically curved blades and tapered rims. *Bolted* scroll liners for easy replacement. High efficiency over a wide performance range.

For *complete* information, contact our nearest office or write for Catalog 905.

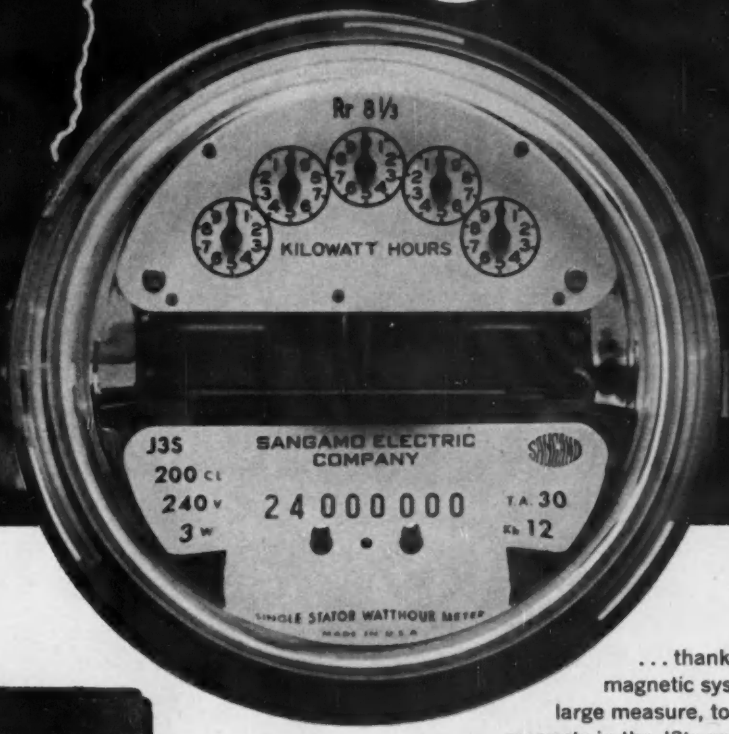
Dependable equipment for making air your servant

CLARAGE FAN COMPANY

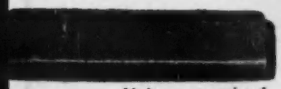
Kalamazoo, Michigan

SALES ENGINEERING OFFICES IN ALL PRINCIPAL CITIES • IN CANADA: Canada Fans, Ltd., 4285 Richelieu St., Montreal

THE SANGAMO J3 SHRUGS OFF SURGES



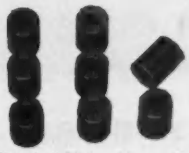
. . . thanks to the permanence and stability of its magnetic system. Permanence and stability due, in large measure, to the high quality and uniformity of the magnets in the J3's controlled floating system.



Alnico as received

Crushed

Ground



Bonded Alnico Magnets

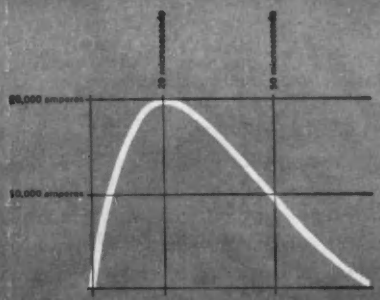
These magnets are made by Sangamo. Made of bonded Alnico. Extra-high coercive force Alnico material is crushed and ground into a fine powder, then bonded into magnets . . . dimensionally and magnetically uniform magnets that have none of the variable characteristics associated with cast and sintered magnets. Each magnet is also thoroughly factory-aged to make sure its strength will not diminish through long years of service.

Actually, all of the components of the J3 are virtually unaffected by high surge currents—even after repeated surges of 20,000 amperes through the neutral wire and 2,000 amperes through the current coils. This includes the electromagnets as well as the Alnico floating system and damping magnets. Surges and short circuits which can de-magnetize even the best chrome steel magnets can't affect the J3 Alnico magnets.

The true magnetic floating system of the J3 never requires maintenance or replacement and is guaranteed for the life of the meter. That's just one of many good reasons why the J3 is your best investment in watthour meters.

Other reasons? A visible, self-cleaning gap; substantially reduced side thrust; insignificant tilt error; advanced insulation level; smallest size; better visibility for inspection and testing; highest torque; slowest speed; lowest watts loss; sectionalized construction; corrosion-resistant finishes and materials; glaskyd base.

Your Sangamo Representative has the complete J3 story. Get it; you'll discover that the J3 has everything you want in a watthour meter. And that's a promise, for this is one of the really great ones.



The J3, with Alnico magnets, easily passes all high current tests of MSJ10.

SANGAMO ELECTRIC COMPANY
SPRINGFIELD, ILLINOIS

J3

JH60-9

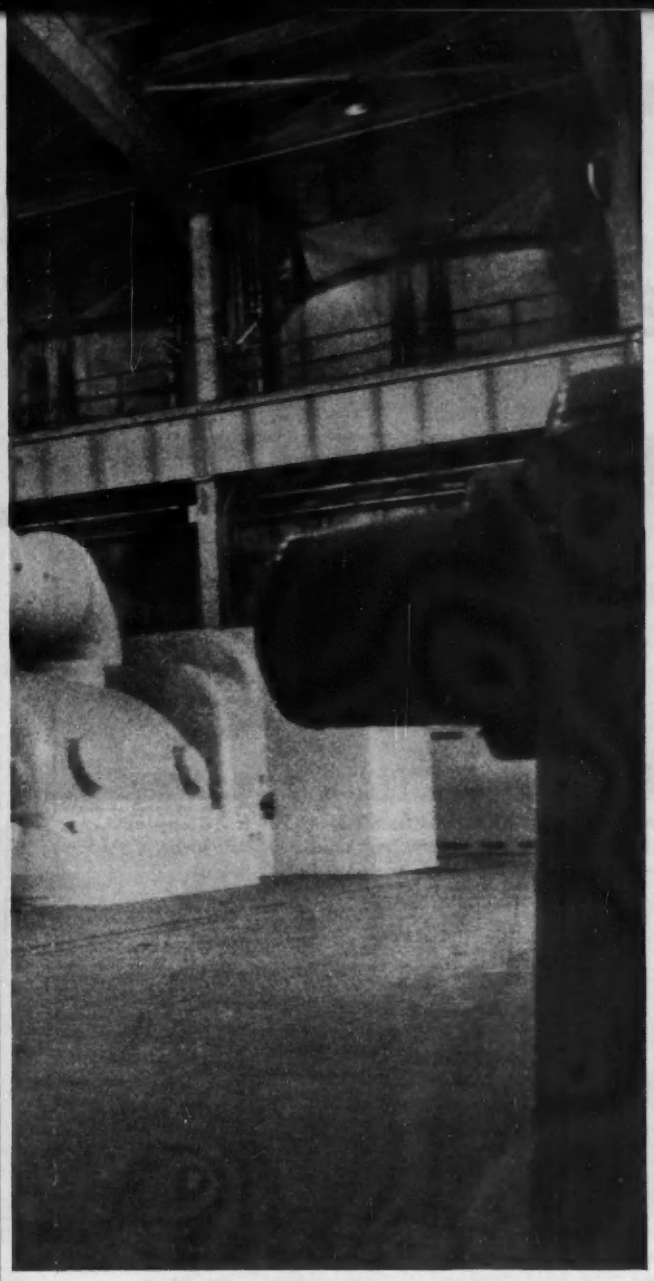
After 200,000 hours Public Service Company of Indiana, Inc.

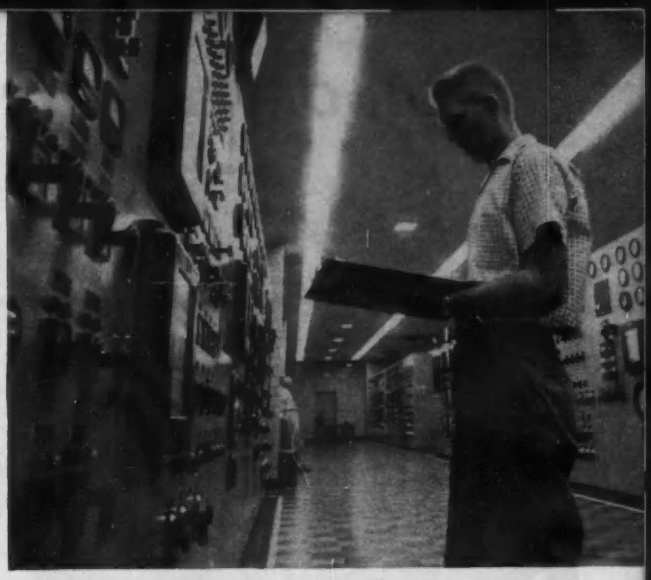
GULF MAKES THINGS

Seven years ago Public Service Company of Indiana, Inc. selected Gulfcrest oil for the first two turbine generators in its Wabash River Generating Station, Terre Haute, Indiana. Now numbering five, this station's generators have spun through more than 200,000 trouble-free operating hours with the help of Gulfcrest oil.

Recently, a sample of Gulfcrest was taken from one of the first two units installed at the station. Analysis showed it was practically the same as new oil. Here are the facts and figures:

	Original Properties	After 40,430 Hours
Color, ASTM Union	1.25	2.25
Flash point, °F	410	415
Appearance	Clear	Clear
Water, % by volume	0	0
Viscosity, SSU at 100°F	151	152.4
Neutralization No.	.04	.03
Interfacial tension, dynes per cm at 77°F	24	29





Control panel readings are taken on rigid schedules at Wabash River Generating Station of Public Service Company of Indiana, Inc. to assure dependable power service in the Terre Haute area. In foreground: C. Lloyd, Control Assistant.

A. Jerrels, Shift Supervisor, right, with Gulf Sales Representative Marshall Ringo. Gulf has been providing lubrication counsel to Public Service Company of Indiana, Inc. since the first two turbine generators were installed seven years ago.

finds Gulfcrest® oil as "good as new"...

RUN BETTER!

Performance records like this are attributable to advanced refining and treatment of selected base oils. Nine different processing operations are performed on the base oils to produce the finished Gulfcrest.

In many large turbine generators Gulfcrest has served continuously for more than 20 years, with neutralization numbers still low, systems still free from sludge and rust. Small wonder that in Gulf's marketing area, more power is generated by central station steam turbines lubricated with Gulfcrest than with any other oil.

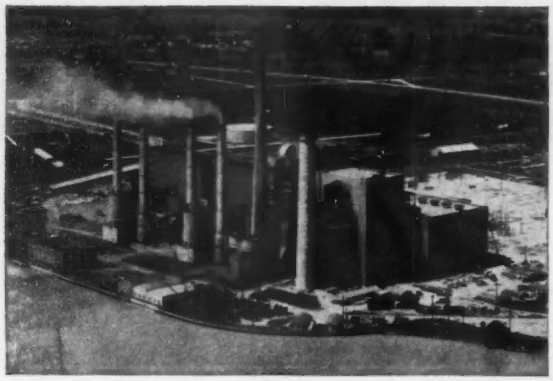
For more information on Gulfcrest, call your nearest Gulf office or write for free copy of illustrated booklet.

GULF OIL CORPORATION
Department DM, Gulf Building
Houston 1, Texas

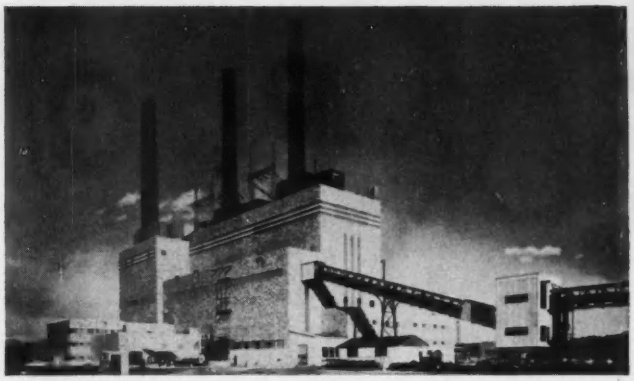
GULF

PROOF OF PERFORMANCE

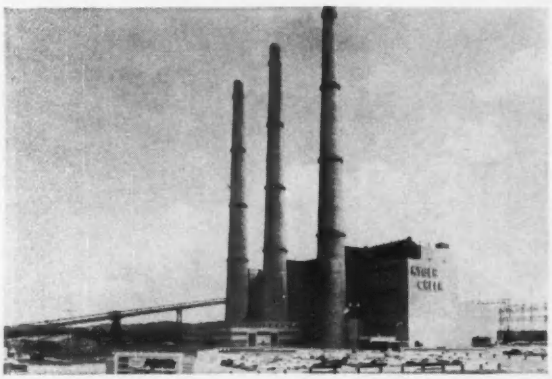
FPC's list of "most finds Bailey users



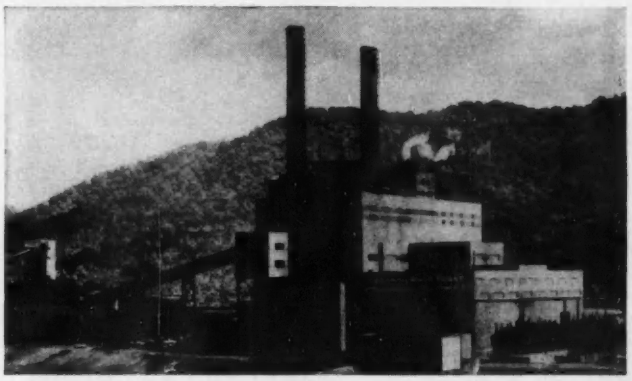
ST. CLAIR (The Detroit Edison Co.)—top 11, 1954-1958, averaging 9222 Btu/kwhr.



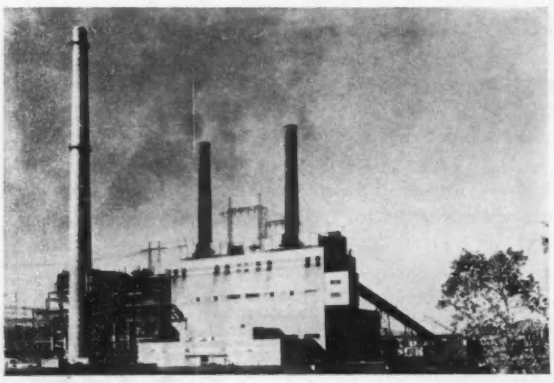
TANNER'S CREEK (Indiana & Michigan Electric Co.)—top nine, 1954-1958, first in 1956, averaging 9204 Btu/kwhr.



KYGER CREEK (Ohio Valley Electric Corp.)—top six, 1955-1958, first in 1955, averaging 9164 Btu/kwhr.



KANAWHA RIVER (Appalachian Power Co.)—top three, 1954-1958, first in 1954 and 1957, averaging 9128 Btu/kwhr.



MUSKINGUM RIVER (Ohio Power Company)—top five, 1954-1958, averaging 9216 Btu/kwhr.

BAY SHORE (The Toledo Edison Co.)—top ten, 1956-1958, averaging 9241 Btu/kwhr.

efficient plants"
as consistent repeaters

Thirteen of the 15 most efficient power plants on the Federal Power Commission's 1958 list use Bailey Meters and Controls.

For most of these plants, this marks the fourth or fifth consecutive year of top-ranked operating economy.

It is significant to engineers responsible for steam plant design and operation, that so many of these top performing plants are using Bailey Meters, Combustion Controls, Feed Water Controls and Superheat Controls.

Today, for breadth of product line, depth of experience and leadership in practical plant automation, no one can offer more to the power industry than Bailey. To apply Bailey's capability to your specific needs, check with the Bailey District Office or Resident Engineer listed in your phone book.

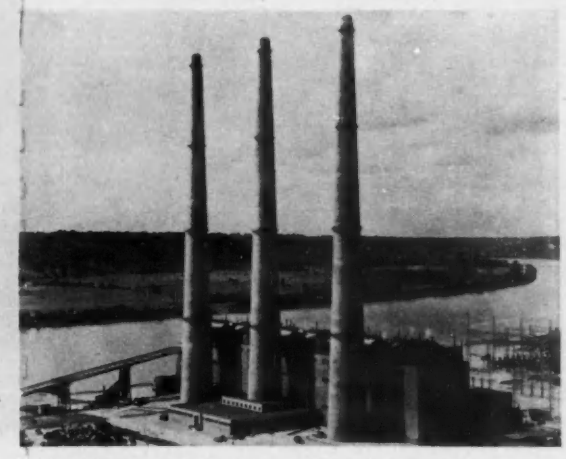
A145-2

Instruments and controls for power and process

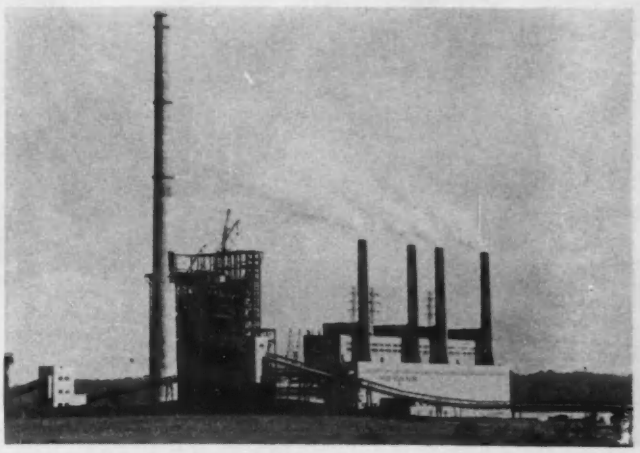
BAILEY METER COMPANY

1060 IVANHOE ROAD • CLEVELAND 10, OHIO

In Canada—Bailey Meter Company Limited, Montreal



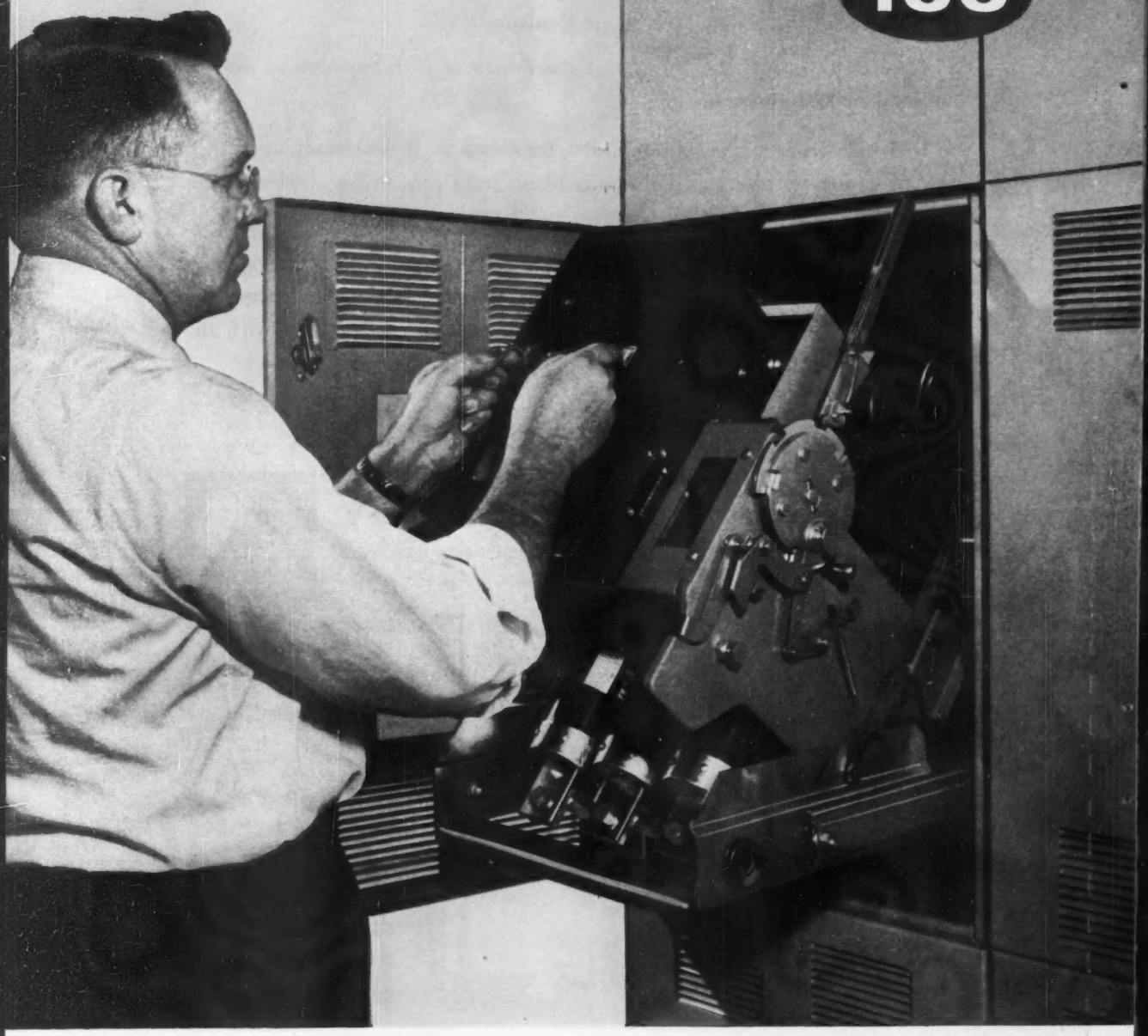
CLIFTY CREEK (Indiana-Kentucky Electric Corp.)—top five, 1955-1958, averaging 9155 Btu/kwhr.



PHILIP SPORN (Appalachian Power Co.—Ohio Power Co.) —top fifteen, 1954-1958, averaging 9378 Btu/kwhr.

PENNSYLVANIA INTRODUCES THE

Loadmaster... 100



...to Give You Full Circuit Protection at up to 30% Less Cost

*Patents applied for

600-volt fused interrupter switch

The new Loadmaster 100*—another first from Pennsylvania—is a 600-volt load interrupter *specifically designed* to employ new current-limiting fuses in drawout switchgear. It combines the economy of a fused interrupter switch with the basic functions of a circuit breaker.

The Loadmaster 100:

Provides full overload protection with new Buss Low-Peak dual-element fuses

Provides complete major fault protection with current-limiting action within one-half cycle

Provides protection against single-phasing

Provides fully-rated systems at the price of cascaded systems

Extends economically the range of substation capacities . . . all this at a considerable savings in equipment cost—the exact amount of savings depending upon the particular application.

Complete Primary and Feeder Coordination

Overload and fault protection with the Low-Peak fuses will coordinate both with primary fuse protection and individual load controls (see fuse coordination curves). In the overload region the Loadmaster has adequate time delay, while under fault conditions the circuit is cleared well before peak current conditions are reached. A fault in any phase clears all three phases simultaneously, preventing single-phase operation.

Provides Fully-Rated System at No Increase in Cost

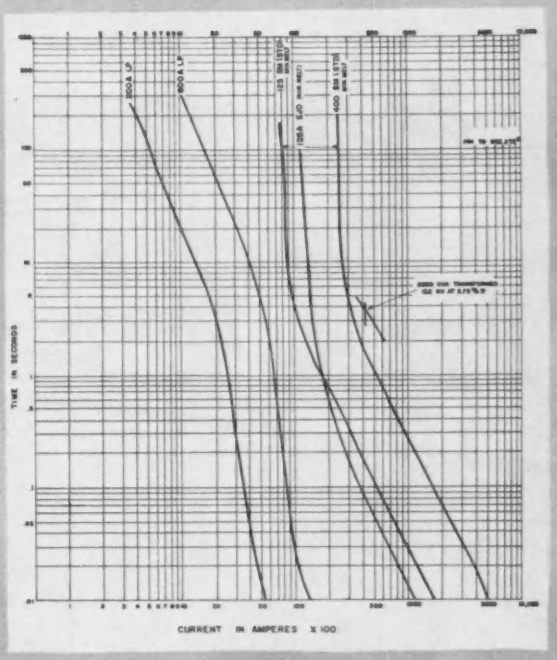
The Loadmaster 100 has an interrupting and close-in rating of 100,000 symmetrical amperes, confirmed by extensive tests at the Bussmann-Thos. A. Edison short-circuit laboratory. This rating makes it possible to provide the advantages of a fully-rated feeder system with the Loadmaster, at the cost of cascading.

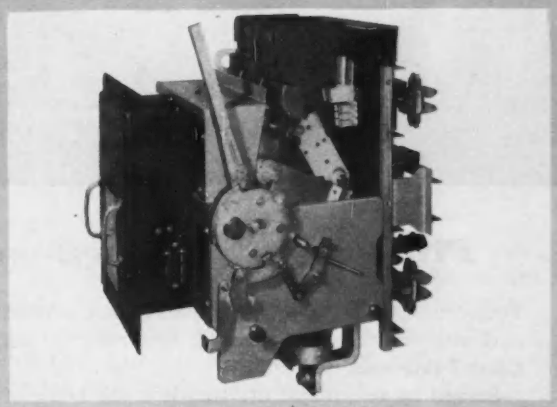
More Kva per Dollar

Larger substation ratings—at less dollar cost per kva—are possible with the new Loadmaster 100. Transformer cost per kva becomes less as the rating increases. Since the standard Loadmaster 100 can replace the large-frame circuit breakers required in systems capable of delivering up to 100,000 amperes, the often prohibitive switchgear cost involved in large substations is eliminated.

Other outstanding features of Loadmaster 100:

- Electrically-operated spring-charged close and trip
- Remote close and trip control
- Blade-type contacts which eliminate bounce
- No live parts on switch front—integrally-mounted fuses requires complete disconnecting from energized bus before inspection and replacement





Overload and fault coordination provided by the Loadmaster 100 are shown by the time-current values for 200-ampere and 600-ampere Low-Peak fuses (left). Low-voltage fuses are readily coordinated with transformer primary protective devices (right).

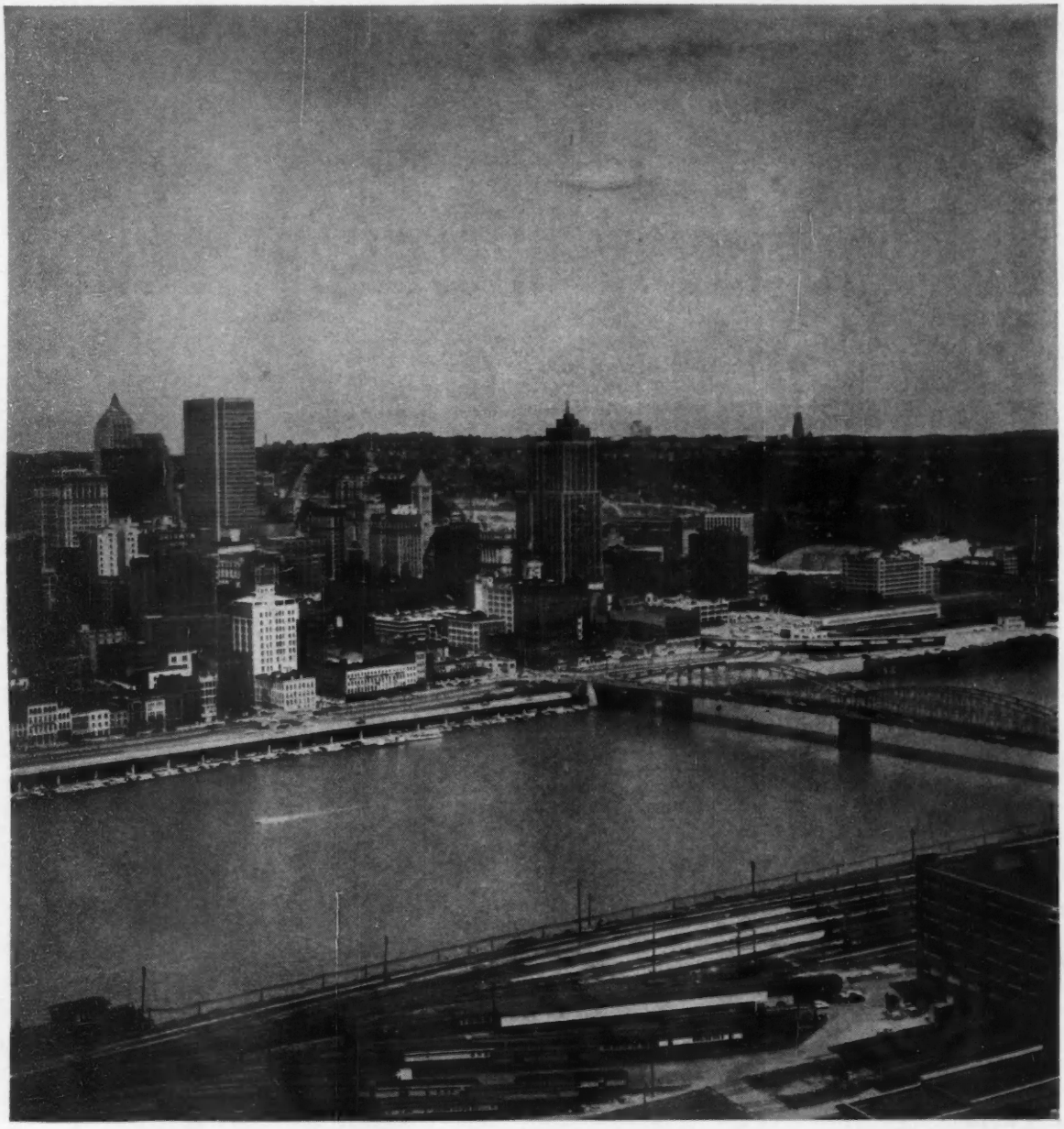
Side view of the Loadmaster 100 shows blade-type contacts. Phase barriers and arc chute at right have been removed.

Pennsylvania Unit Substations

PENNSYLVANIA TRANSFORMER DIVISION

McGRAW-EDISON COMPANY · CANONSBURG, PENNSYLVANIA

over 31 years' experience . . . builders of transformers from 5 to 500,000 kva; 24 to 460 kv



Pittsburgh, Penn-syl-vane-eye-aye

Founded in 1758, Pittsburgh, Gateway to the West and steel center of the world, is served by six Class I railroads.

Served by two major utilities, it is the home of the world's first full-scale commercial nuclear power plant.

To supply the electric cable needs of such a metropolis, Kerite was ready with a standard of dependability which began in 1854. *And as the need for quality cable continues to grow, Kerite will be ready to supply it.*

KERITE CABLE

it's the **KERITE** *that makes the difference*

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Utility Forecast: Some Clouds, Mostly Fair

This issue contains our latest effort to penetrate the fog of the future. This forecast may not be as accurate as radar but it is sufficient to provide rough outlines of good and bad economic weather ahead.

Our latest reading pretty much confirms previous encouraging estimates for the more distant future. But directly ahead it indicates a minor disturbance.

For instance, residential kwhr sales are heading for a moderately successful 9.2% increase this year buoyed by 1959's housing boom and the binge in new appliance purchases. For next year we peg the gain at a slower 8.3% due to disappointing home construction and appliance sales this year.

Commercial sales are more stable, growthwise, and so we expect them to rack up gains of 8.5% both this year and next, under the impetus of new commercial construction and modernization.

Industrial is the most volatile area of kwhr sales, as usual, reflecting fluctuations in production. With no real boom on the immediate horizon it appears industrial kwhr sales will chalk up a 5.6% increase this year, buoyed by a last-quarter pickup in steel and auto production. Next year's gain should be a more sobering 4.2% since all indications are that the very important auto industry will find it rough to duplicate this year's peppy performance.

Fortunately, electric utilities usually perform somewhat better than the general economy. Thus, we expect kwhr sales to all customers to increase 7.1% this year and show a comfortable 6.1% gain next year.

All this, of course, is taken from *Electrical World's* Forecast starting on page 103. As you get into it you will also find an industry-wide forecast for the period 1960 through '62 based on an *EW* survey of company energy sales forecasts for individual systems.

Additional data obtained from these returns, although not included in our forecast report, explain each company's reasons for predicting gains in kwhr sales of different customer classes.

Of the 139 utilities giving reasons for residential sales increases 104, or 74.8%, mentioned "greater appliance saturation." Some also credited specific appliances. For instance, 54 or 38.8% mentioned air conditioning. Water-heaters ran a poor second with six mentions or only 4.3% of total replies. Other "appliances" identified with growth were TV sets and air cleaners with one mention apiece.

The second biggest spur to residential sales was electric space heating, checked by 58 or 41.7% of respondents. Other reasons given were "historical trend" by 46 or 33.1%, lighting 21 or 15.1%, expanding population 12 or 8.6%, new home construction 9 or 6.5%, "Medallion Home Construction" 5 or 3.6% and "greater use per customer" 2 or 1.4%.

For commercial sales increases the same 139 respondents gave these reasons. First again was air conditioning with 80 mentions or 57.6% of total replies. Lighting was a close second with 78 mentions or 56.1%. "Historical trend" took third place with 54 mentions by 38.8% and electric heating drew 30 votes from 21.6% of reporting companies. Commercial cooking was mentioned by 10.1% or 14 companies. Other specific mentions were refrigeration five, water heating three, and air cleaners again with one.

If nothing else, these replies indicate that individual utilities, with their fingers directly on the pulse of the local situation, have sound reasons for optimism. And we're happy to report that the sum of their forecasts coincides closely with our own independent forecast for the industry.

Regulatory Agencies Conference Called

President names Federal Appeals Court judge temporary chairman of meeting find ways to improve agencies

President Eisenhower has entered the arena of debate over problems of the federal regulatory agencies, such as the Federal Power Commission. He has called for informal talks—a new "Conference on Administrative Procedure"—this fall, and has named Judge Elijah Prettyman (Washington, D.C., Federal Appeals Court) as temporary chairman of the conference.

No date has been set for the conference, although it probably will will be announced this month by Prettyman. Announcement of the hearing date also will include the name of the person selected as full chairman of the group.

The conference won't have any statutory authority, won't issue any new rules. It is intended only to discuss regulatory problems: particularly, the delays in processing of cases before the various commissions. In fact, the chairmen of six regulatory bodies, who recommended the conference to President Eisenhower, also urged that it be held in an informal manner without attempting to impose rules on the agencies. They added also that the conference should only be temporary —not a permanent agency to investigate the affected agencies.

Seven Asked for Meeting

The agencies whose chairmen called for the conference are: Federal Power Commission, Securities & Exchange Commission, Federal Trade Commission, Interstate Commerce Commission, Federal Communications Commission, and Civil Aeronautics Board.

Prettyman was chosen temporary chairman of this group because he led, in 1953-'54, an earlier Presidential Conference on Administrative Procedure.

Chief Justice Earl Warren, along with other Administration officials, has recommended that the conference be turned into a permanent body to review regulatory actions—something that may require Congressional approval. However, the proposed conference, as Eisenhower sees it, won't involve permanent status or binding recommendations on the federal regulatory bodies involved.

US Supreme Court Justice Tom Clark also urged formation of a permanent regulatory commission policing agency. Clark told a session of the recent American Bar Assn that "Present habits as well as bad procedural behavior of the agencies can be largely corrected within the present statutory framework," rejecting the suggestion that quasi-judicial bodies be created to replace the present form of regulatory commissions. Clark said he approves of Prettyman's coming Conference on Administrative Procedure. He hit at delays by the various regulatory bodies in disposing of cases, for putting into their records "everything but the kitchen sink," and for "procrastinating on over-all policy."

Sen Kenneth Keating (R-N.Y.) also has called for a permanent "National Advisory Committee on Administrative Practice and Procedure" to "recommend to Congress and the President a program for removing any evils which have crept into our administrative system . . . In my opinion . . . the entire structure of administrative government must be thoroughly reviewed, and what ever reforms are needed—however bold they may be—must be promptly instituted. The agencies must grasp the fact that unless they have the confidence of the public and other organs of the government, they face the danger of eventual annihilation."

Keating also praised Prettyman for doing "outstanding work in this field" of regulatory control.

Six Pennsylvania Utilities Reduce Rates

"Voluntary reduction" of rates have been made by six electric utility companies in Pennsylvania since the Pennsylvania Public Utility Commission's investigation of their revenues started about three months ago (EW, June 6, p 42; July 4, p 34). However, spokesmen for some of these companies add that this action would have been necessary eventually as the result of the Commission's probe.

Largest company to make reduction was Pennsylvania Electric Co, which shaved 3.6% from its annual revenue, or $2,273,000. South Penn Power Co reduced its rates $55,300 annually, Cumberland Valley Electric Co, $26,600; Waterford Electric Light Co, $2,600, and Rockingham Light & Heat Co, $5,200. A $25,900 cut was put into effect by Harvey's Lake Light Co, of Luzerne County, in July.

Metropolitan Edison Co, also subjected to the Commission's investigation, was found not to be making excessive profits; therefore it is making no reduction in rates.

The Commission is continuing its investigation of rates of Philadelphia Electric Co, Pennsylvania Power & Light Co, Duquesne Light Co, Pennsylvania Power Co, and West Penn Power Co.

Pepco Develops Employee Recreational Park

Potomac Electric Power Co is developing a 519-acre recreational park for its employees on the Potomac River, north of Washington, D. C. It will have an 18-hole golf course, club house, tennis courts, baseball and softball diamonds, a boat marina, camping areas, picnic areas, children's playgrounds, and nature trails.

The land was bought in 1955 for Pepco's Dickerson steam plant. The plant was built across the river in Maryland, when difficulties arose between the company and Virginia officials over its construction.

Pepco is contributing use of the land and cooperating in the initial financing. Future costs will be divided among members of a Recreational Association formed to operate the park.

Wild surf and bending palms at Miami show the force of . . .

. . . Destructive Donna

Hundreds of thousands of customer outages and uncounted dollars of damage were the price paid by utilities as Hurricane Donna, the East's first serious 1960 storm, danced up the coast from Florida to northern New England. Although the center of the storm skipped out to sea several times enroute, and no major damage to generation or substation installations was reported, several companies reported that damage to feeders and customer interruptions was the most extensive ever suffered. And without extensive and growing utility disaster programs and storm warnings, damage could have been much more serious and outages longer.

In Florida Power & Light Co's Greater Miami area, 150,000 customers were without service after the storm, and 50,000 to 100,000 customers in the rest of the system, from Sarasota across to Dayton. The center of the storm, hitting at the "gold coast" or the Gulf area, was worst at Naples, on the Keys, and at Ft. Myers, then lost its force at Daytona Beach. Falling trees and flying limbs were the biggest problems, rather than fallen poles.

Restoration of service was effected "quite quickly" with only 1% of the system's lines still in trouble by Wednesday, Sept. 14. The hurricane hit the first part of FP&L's area Friday afternoon, Sept. 9, and lasted 15 hr. It was labeled by vice-president M. B. McDonald, as "the most sustained storm to date, but far from the worst."

FP&L's distribution lines have been re-engineered several times for better storm precaution, with extra guying added and many other modifications.

Service Restored by Midnight

Of Florida Power Corp's 260,000 customers, 40,000 were knocked out by the storm. Service on all lines was restored by midnight, Sept. 14. Damage was "not over $100,000." Fourteen extra crews were used, all contractor crews except one loaned by Georgia Power Co.

Major damage was in the Gulf Coast and central Florida areas. Six out of 81 feeder lines in St. Petersburg went out. Service was restored there Sept. 13. The utility expected to have the balance of its service repaired by the same day.

Substation and transmission damage was slight, with only one-half of one substation out and two or three transmission lines, longest of which was 50 miles. No generating stations were flooded.

Damage in Tampa Electric Co's territory was very scattered, with the hardest hit area that part of Lakeland served by a municipally owned utility, but there was little in the part served by TE Co. Next worst damage was in Tampa Electric's Plant City, Winter Haven, and Dade City areas, with most in Plant City. "Several thousands" were without service. Damage to substations and transmission lines was "of no consequence"—

The bulk of the utility's service was restored by Tuesday for restoration. Television and radio appeals on Saturday, Sept. 10, before the gale started, asked all electrical workers in the utility's area to report to union halls to help out during the storm. Many contracting firms and individual electricians answered the call and were still on duty Sept. 13.

Moving through Georgia, Donna

New Bedford, Mass. . . .

was comparatively merciful. Georgia Power Co reported its damage was centered at Brunswick and described it as "extremely small in terms of dollars." Only 100 customers were affected at any one time, and total outage was from three to four hours. Georgia Power released three contract crews and three of its own crews for emergency duty help to Florida Power Corp at Winter Park.

South Carolina Electric & Gas Co had some minor distribution damage with several widely scattered cases of serious damage. At the height of the trouble there were some 5,000 to 10,000 customers without service. Storm winds hit at noon on Sunday, and most service was restored by 6 pm the next day. The utility used eight contract crews for repairs in Charleston, but released five of them to help Carolina Power & Light Co in Wilmington.

Carolina Power & Light's territory covers about 30,000 sq miles but Donna spared all but 1,250 sq miles of it.

Past hurricanes have done little or no damage to the company's transmission lines, but Donna blew two steel towers of a 110-kv line into the Cape Fear River. Three of the five circuits operating from the Louis V. Sutton generating station were knocked out of service. They serve Wilmington, Moorehead City, Beaufort, New Bern, Wrightsville Beach, Camp LeJeune and Cherry Point Marine Air Base.

A 110-kv circuit between Goldsboro station and Jacksonville was also out of service.

Line crews had to work out of boats in the low, mucky region.

Repair and mop-up crews were organized Sunday night and dispatched in the early hours of Monday morning. Of the 600 men on the job, 33 were contract crews, eight crews were borrowed from Duke Power, 23 were tree-trimming crews and the rest were CP&L.

Service Restored Same Day

By 10:30 am Monday, power was restored to downtown Wilmington, and by 7 pm 90% of the entire Wilmington area load had been restored. The other cities also had service by this time.

Hardest hit in the middle South was Virginia Electric & Power Co, which suffered extensive damage over a 20,000 sq mile area.

High winds swept inland—almost to Richmond—dropping trees and roofs on distribution lines and leaving 100,000 customers out of service at the peak of the trouble.

Early estimates placed dollar damage at about $500,000.

Service was restored by 52 crews, all but 15 of which were VEPCo employees. Only one transmission circuit, a 110-kv line from Suffolk, Va., to Elizabeth City, N. C., was knocked out. It was back in service 10 hours after the storm struck.

At Long Island Lighting Co, Stanley Richards manager of Overhead Lines and Services, said the "storm was the worst LILCo has experienced in the number of customers affected and in the extent of the area of damage," despite the fact that the company's system had been considerably reinforced since hurricanes in 1954.

At the peak of the storm, 10:30 am, service was interrupted to 230,000 customers. This was reduced to 119,000 to 9:00 pm Monday and to 85,000 by 9:00 am Tuesday.

To get the lines back in service, LILCo borrowed 300 men from upstate New York utilities. Men from Buffalo were flown in to all three major New York City Airports and met there by LILCo personnel. Others came by bus to lend a hand. Line trucks were borrowed from Consolidated Edison Co of New York, Niagara Mohawk Power Corp, and New York State Electric & Gas Co. LILCo had some 2,000 of it's own crewmen in the field.

In all, 128 feeders were dropped. Several of these were pulled at the request of the police because of the hazard from the heavy water and the fallen lines.

Originally, LILCo had planned to move men into the eastern end of Long Island, toward Montauk Point, where the eye of the hurricane was expected to pass. However, the unpredictable Donna shifted her path and passed right over the Hicksville operating center, where the crews had been concentrated.

Although the "eye" of the hurricane passed directly over the US Weather Bureau station in lower New York City, where 95-mph winds were recorded, the city itself suffered less severely than its suburbs. Most trouble was in Con Edison areas not supplied by the underground network. There were, however, a few underground fires attributable to water, and the

weather station itself lost power to some of its instrumentation from this cause at the height of the storm.

On the Con Edison system, city outages totaled 18,120. The company, after lending nine crews to LILCo, put some 300 crews in the field, where normally it would have had 30.

Serious damage reported on Monday included 54 wires down, and 25 trees on wires. Spokesmen considered that the company has gotten off easier than during the 1954 and 1955 hurricanes.

In New Jersey, Donna left at least 300,000 customers without power during the worst of the storm. Public Service Electric & Gas Co reported 223,000 customers out of service, while Jersey Central Power & Light and New Jersey Power & Light jointly lost about 75,000 customers.

The storm hit this state Monday morning. By noon Wednesday, PSE&G has restored all its customers. The two General Public Utilities subsidiaries reported all customers were back in service by noon, Tuesday.

Most of the damage in both areas was caused by trees and limbs on distribution lines. In the JCP&L-NJP&L area, three 34-kv lines were blown down near Raritan Bay.

One consolation for Public Service was the performance of their storm-proofed aerial cable installations. According to PSE&G, "Performance of the new aerial cable standards was highly satisfactory during the storm. Considerably more interruptions would have been experienced," they said, "had not the storm-proofing program been underway for the past two years." In addition, the values of a previously established disaster plan, including a trial mobilization, was clearly established by the storm.

Neither Public Service nor the GPU companies had to draw on other utility help. All service was restored by the companies own crews and the help of contractors and tree-trimmers normally used on the system.

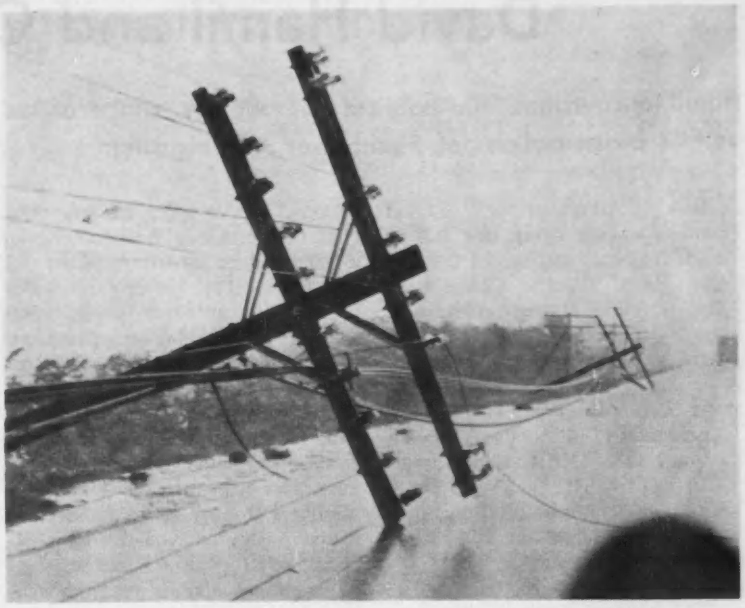
Damage was heavy in eastern New England centering along a line from Rhode Island to Quincy, Mass, and the North Shore.

New England Electric System estimates that between 125,000 and 150,000 customers were without service at the peak of the trouble. By noon Tuesday, the outages had been reduced to 70,000. NEES called in 20 crews from other companies, including Niagara Mohawk, Central Vermont Power Co, and Western Massachusetts Electric Co, and shifted 25 of their own crews from areas not hit by the storm to the trouble center.

In Rhode Island, the 69-kv transmission line was out for several hours because of salt spray on the generator switchyard. Another 33-kv line was out temporarily in that area. Although tides were high for several hours and all central stations were sandbagged, none of the steam stations were damaged.

At the peak of the trouble, Boston Edison had 160,000 customers or one-third of their total without power. However, a spokesman said they expected to have all but 3%, about 15,000 customers, back by dusk Tuesday, 24 hours after the peak of the storm.

BE, too, relied on help from other utilities, flying in 200 men from Consumers Power Co and Cleveland Electric Illuminating Co. Additional crews from New York State came by road, bringing their own equipment. The Boston utility reported no flooding in its underground system and no transmission or substation damage.



. . . Lower Keys, Fla.

Although damage in Connecticut was widespread, crews working throughout the storm got most customers back within 24 hours.

United Illuminating Co lost a total of 14,000 customers in Bridgeport, New Haven, and surrounding areas, but all were restored to service within 24 hours. Most of the damage was overhead distribution lines, although a few underground vaults were flooded.

In the Stratford, Conn., area, UI lost one distribution substation serving 1,200 customers when winds took down poles carrying 13-kv and 6.9-kv feeder lines. After an outage of about 10 hours, service was restored by moving a mobile substation and connecting it to the fallen feeders. UI spokesmen said use of the mobile prevented a 24 or 36 hour outage.

Connecticut Light & Power Co reported about 73,000 customers had interruptions at one time or another. By noon Tuesday, all but 12,000 of the customers, scattered throughout the company's franchise area, were restored to service.

At Hartford Electric Light Co, peak outage involved 35,000 customers. Included in this total were 15,000 customers in Middletown, Conn., where water in a large piece of switchgear interrupted service to the entire town for about one hour.

David Hamil and Clyde Ellis Star

Hamil encourages non-political attitude by cooperatives as Ellis blasts policies of Eisenhower Administration

DAVID HAMIL

REA Administrator David Hamil, speaking again this fall at the 10 regional meetings of the National Rural Electric Cooperative Assn, is telling the co-ops how to improve their operations, and emphasizing that rural electrification is neither a Republican or Democratic accomplishment.

Incidentally, he is also plugging the new 2% REA bond series which went on the market July 1: "Within two months after the new bonds were placed on sale, REA borrowers had purchased nearly $4-million worth.

"The history of our cooperatives has all the elements of a great American success story," says Hamil. "We didn't ask for hand-outs, we asked only for a loan program . . . we started with a zero net worth, and we have pulled it up to an average for all our cooperatives of more than 18% of assets."

Speaking of the coming national elections, Hamil says, "Naturally, I am concerned with the outcome of the elections. Everybody knows my politics, just as everybody knows the politics of NRECA's capable general manager (Clyde Ellis), who was once a Democratic Congressman from the state of Arkansas. But neither of us can take credit for REA. No one person, no one party, no one administration can take credit for the achievements of rural electrification. The Rural Electrification Act was born with bi-partisan support. Appropriations for REA have been voted by Congresses controlled by both parties."

Hamil admits "this Administration has made a couple of recommendations with which some of you disagree," and he thanks NRECA for inviting him to appear at the regional meetings "even when you felt pretty sure that you would disagree with me on a point or two. I appreciate your courtesy and your sportsmanship . . ."

The REA administrator makes a series of recommendations for improved rural electric service because "people expect more of you than ever before: more 'hot line' work; a faster outage reporting system . . . see to it that (co-op statewide) papers and all your public relations people get a big enough budget to help you keep members fully informed. No matter how good your management, you cannot have a good cooperative unless it is run by co-op principles. Your members must have a hand in its affairs . . . Members today, as a matter of course, insist that you run their cooperative in a businesslike way."

Hamil repeats his previous recommendations for "long-range engineering planning, with a system based on expectations of load three to six times as great as current loads . . . (and) an annual work plan, based on this long-range system plan . . . Develop a financial forecast, based on a financial plan, which looks ahead at least 10 years . . . Funds not needed for plant—and which will not be needed in the foreseeable future—should be used to make advance payments on your REA loans . . . Keep certain funds on hand for working capital, replacement, and to meet emergencies . . . take a critical look at these liquid assets. Some of you have stacked up a lot of money . . . don't worry too much about amassing large amounts to meet replacements and emergencies. Your business is a continuing one, and the cash will continue to come in. Also, REA has a good record of assistance when emergencies arise."

The REA bond issue is plugged by Hamil as one means of using some of the co-ops' liquid assets. "Once you decide what (money) you need on hand," he is saying, "we recommend that you consider purchasing the new 2% treasury bonds . . . you have a right to invest your own funds as you see fit. But all of you have seen editorial criticism of borrowers who borrow money from REA at 2% and invest their own funds in higher-yield securities . . . Keeping in mind that the government has given you the privilege of borrowing federal money at 2%, you should welcome the chance to invest your own funds in a manner that you can be sure is morally right . . ."

Ellis Talk Colored by Elections

The 10 regional meetings of the cooperative will also be treated to a colorful speech by their general manager, Clyde Ellis.

Ellis points out that this year—as in 1952—a new administration is about to be born, and a "new era in rural electrification" is beginning.

Ellis' talk, "Days of Decision—Yours, Ours," ponders which new administration (Republican or Democratic) will be good for the NRECA program. "We have done everything we know to do to present our case to both sides—to both political parties," says Ellis.

Blasting the Eisenhower Administration, Ellis recalls, "As the years passed after 1952, we were jolted time after time by the policies and actions of the new Administration." He details a number of complaints:

- "New Missouri Basin marketing criteria threatened our program in several states. We got modified, but is still hurts.
- "Power costs in multi-purpose projects were re-allocated upward arbitrarily.
- Southwestern Power Administration rates to us (co-ops) were raised 40% in the Southwest until

on NRECA Regional Programs

CLYDE ELLIS

we got the increase modified to 27%.

• "Tennessee Valley Authority was derided by President Eisenhower . . . the Dixon-Yates scheme was designed as a device to invade TVA, and was abandoned only under the pressure of conflict-of-interest scandal.

• "The word 'partnership' was used to cloak an official policy of giving away Hells Canyon and other dam sites for power company exploitation and under-development. 'No new starts' became the Administration's announced policy regarding multi-purpose dams and other resource development.

• "The government's transmission program, to tie the dams together and to provide for a sort of common carrier pooling of all power sources in the area, and deliver the federal wholesale power out to load centers, was practically stopped—sacrificed on the altar of 'partnership.'

• "The new Federal Power Commission and New York Power Authority killed the major benefits of St. Lawrence power for the so-called preference customer electric co-ops and municipally-owned systems. Congress and the New York Authority together did the same with Niagara power.

• "We were told the power companies would have to be cut in on the benefits of generation and transmission loans (REA)—and it was done.

• "Without consulting you, the Administration told the Congress that the REA interest rate should be hiked under a formula that would double or triple it.

• "We were astounded to see a memo in which the Secretary of Agriculture ordered the REA administrator to campaign throughout the country for these proposals.

• "We were shocked at a secret order which took away the REA administrator's authority to approve loans without checking them in advance with a political aide in the (Agriculture) Secretary's office in Washington.

• "Out of the blue came a decision by the Comptroller General which would have prohibited us from serving anyone a power company wanted to serve, and would have required your systems to return to REA at once untold millions of dollars borrowed in good faith from REA."

SEC Utility Borrowing Policy Test Foreseen

A controversial Securities & Exchange Commission policy that could cut utility borrowing power may be headed for a test case as a result of an application recently filed by Kentucky Power Co and American Electric Power Co to finance KP's new Big Sandy Plant.

At issue is an SEC statement of policy, issued Feb. 29, 1960, which says financial statements filed with the Commission will be considered inaccurate or misleading if accumulated tax credit resulting from fast tax write-off is designated as earned surplus or equity capital. In their application to sell $40 million in notes to finance Big Sandy, AEP and KP ignored the SEC requirement. AEP identified about $87 million on its consolidated balance sheet as "Earned surplus Restricted For Future Federal Income Tax," while the Kentucky Power balance sheet listed about $730,000 in the same manner.

As a result, the SEC has now set Oct. 3 to begin hearings on the financing proposal. At the same time, the Commission will attempt to determine if the two companies' accounting meets SEC rulings and, if not, what should be done about it. Kentucky Power had requested a hearing to determine if the SEC had the authority to make the utility change its balance sheet classification.

Since the Kentucky Commission requires provisions for net taxes to be classified as restricted earned surplus, the basic issue in the test case may be that of deciding who—the individual state commissions or the SEC—has primary jurisdiction in setting bookkeeping practice. Since the SEC policy applies to the Securities Act as well as the Holding Company Act, it could affect most major utilities.

Moreover, since many states restrict borrowing by utilities to a fixed percentage of their surplus, a reduction in the amount of surplus could limit the amount the utilities could borrow to finance modernization and expansion.

In commenting on the conflict, AEP President Philip Sporn said, "It is our firm belief that financial statements reflecting accounting prescribed by state regulatory authorities having rate jurisdiction over substantially all of the system's electric operating revenues are most meaningful to investors and to the public." Classification of the $80 million as restricted earned surplus has resulted in the most economical financing, he said.

Noting that the SEC practice would supersede authority of state commissions in an area where they were intended to have primary jurisdiction and that it could materially affect customers' rates, Sporn said AEP would "welcome the opportunity to substantiate its views."

Buffalo Industries Object to Niagara Rates

A group of Buffalo industries is considering an appeal to the Power Authority of the State of New York (PASNY) for a more favorable rate structure on power that will be allocated to Buffalo from the new Niagara development (EW, Sept. 12, p 50).

"The proposed rate structure is not adaptable to Buffalo," said a spokesman for the Buffalo industry group.

There were reports that a meeting may be sought in New York City with PASNY representatives.

Some Buffalo industrialists have described as "discouragingly small" the savings in power costs that would be gained in taking power from the new $720-million Niagara development.

"We don't like to pass up the power that would be allocated to us from Niagara but we may have to," said the manager of one Buffalo plant who is objecting to PASNY's power charges as they apply to Buffalo industry.

PASNY proposed rates on the new Niagara power reportedly are most favorable to industries which use a large percentage of their maximum power almost continuously—in other words, those with plants that operate around the clock every day of the year.

Most of the Niagara Falls industries scheduled to get the new Niagara power are of the type that have such a continuously high power-consuming load factor.

Buffalo industries, generally, are not of this type.

A Buffalo industry that figures it would have to pay 5 mills per kwhr of electric power from Niagara says the rate would be closer to 4.2 mills for industries with a continuous high load factor. PASNY has not disclosed the rate schedule.

However, it is known that PASNY has proposed two rate structures on the new Niagara power, with industries being able to pick the one most suitable for its purpose. The Buffalo group, in effect, is seeking a third rate structure that would be more adaptable to the nature of power-using industrial operations in Buffalo.

Niagara Mohawk Power Corp will distribute the new Niagara power for PASNY along with the power it continues to supply industry. Presumably, industrial customers will be billed at the PASNY rate for power allocated them from Niagara and at the Niagara Mohawk rate for any balance they get from Niagara Mohawk to meet their full power requirements.

To qualify for 60-cycle power being allocated them from Niagara, industries in Niagara Falls and Buffalo will have to convert a like amount of their present 25-cycle power to 60-cycle.

The Niagara Falls industries are committed to converting from 25-cycle to 60-cycle anyway. Buffalo industries are not. Although there still are three 25-cycle generators in Niagara Mohawk's Huntley Station and 25-cycle converters elsewhere in the area, the supply of 25-cycle power will be dwindling in the years ahead.

Top Speakers Lined Up for EW Meeting

How utilities, manufacturers, and local governments can meet the challenges of attaining good street and highway lighting will hold center stage at *Electrical World's* Second Street and Highway Lighting Conference. The meeting will be held at the Hotels Ambassador, Chicago, Illinois, October 19 and 20.

Speakers include T. L. Sharkey, manager, rates and pricing department, Ebasco Services Inc, who will talk on "Rates and Regulatory Problems of Street Lighting Service"; Stacy Standley, product manager, lighting, Line Material Industries, "The Need For More Highway Lighting"; Warren H. Edman, vice president in charge of street lighting, Holophane Co, and chairman, Illuminating Engineering Society subcommittee on standard practice revision, "Requisite Roadway Lighting-Present and Future"; and J. A. MacCracken, street lighting engineer, New England Electric System, "Economics of Street Lighting."

L. M. Johnson, commissioner, Department of Streets and Sanitation, for the city of Chicago, will give a talk on street lighting progress in that city.

A special feature will be a talk by Mrs Dexter O. Arnold, 2nd vice president of the General Federation of Women's Clubs, who will present the viewpoint of the consumer and tell what the average homeowner and parent expects of street lighting.

Roy W. Johnson, chairman of the board, American Council To Improve Our Neighborhoods (ACTION), will be the first day luncheon speaker. He will discuss the part of street lighting in urban redevelopment.

Importance of Bond Issue Underscored by Californian

Resigning as California director of water resources, Harvey O. Banks has stressed that he agreed to stay in office until January in order to press his support of a water resources development bond issue to a satisfactory conclusion.

"There is no issue on next November's ballot more crucial to the welfare of California and to the orderly progress of its economic development," Banks said, emphasizing his support of the $1.75-billion bond issue to be voted upon Nov. 8.

Banks, who has been director of water resources since 1956, said, "It would be tragic indeed, if the efforts of those few who create misunderstanding and confusion over this issue were to result in the defeat of the bonds." He pledged himself to explain the issue to the voters.

Banks will become vice president of a new San Francisco office of Leeds, Hill & Jewett, Inc, a Los Angeles consulting firm. William E. Warne, former state assistant secretary of the interior and assistant reclamation commissioner, has been appointed Banks' successor.

DELTA SUBSTATION is on site of old Louisville & Nashville railroad station and supplies New Orleans downtown business district at 13.8 kv although the sub was designed and built for future operation at 23 kv

Substation Squeezed to Fit Site

80-Mva sub is flexible, reliable, economically built, and serves half of New Orleans commercial network load

SEYMOUR CAMBIAS JR,
New Orleans Public Service Inc,
New Orleans, La.

An 80-Mva substation, recently placed in operation by New Orleans Public Service Inc, was built for maximum flexibility and reliability on limited land and at a reasonable cost. Called Delta Substation, it supplies about half the city's commercial network load.

The substation, stepping down voltage from 115 to 13.8 kv, is on a 96 x 250-ft plot a few hundred feet from the Mississippi River. It can supply 24 13.8-kv feeders through five 25/33/41.667-Mva, tap-changing-under-load transformers. The 115 kv comes via a 954-MCM ACSR-conductor, double-circuit, steel-tower line paralleling the river. Taps to the substation are 600-MCM copper.

Construction from pile driving to "in service" took eight months, and the project's total cost, exclusive of land, was $1.1 million. The company's Engineering Department designed the substation and contracted for and supervised the construction.

Station functions are controlled from the system control room at Market Street Generating Station over a supervisory control system through leased wires. All 115-kv disconnect switches and circuit breakers are controlled and their circuits are metered remotely from there. All operational requirements, except service restoration after a 13.8-kv bus fault, can be satisfied from the system control room.

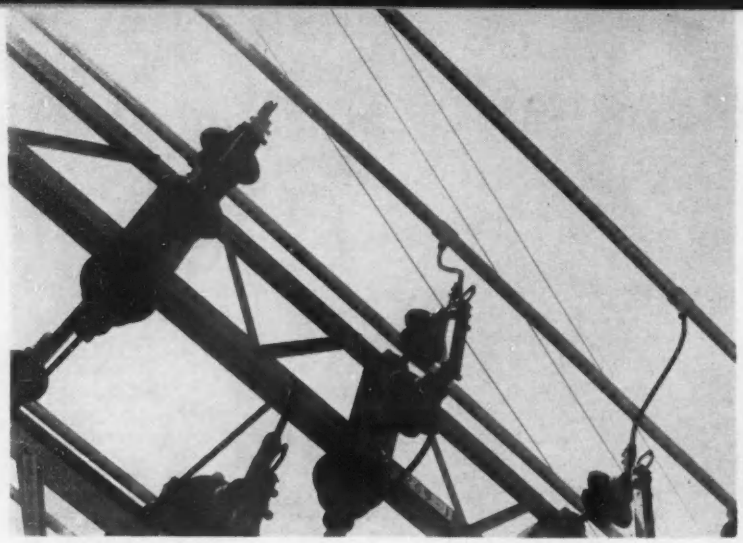
The latter restoration must be switched manually at the substation.

The substation consists of outdoor components, no switchgear being metal-clad. The initial installation has the following 23-kv equipment: Two 25/33/41.6-Mva transformers; two 2,000-amp, 1,000-Mva transformer circuit breakers; one 2,000-amp, 500-Mva bus-tie circuit breaker; and 12 1,200-amp, 500-Mva feeder circuit breakers, with associated 115-kv motor-operated and 23-kv hook-stick disconnect switches.

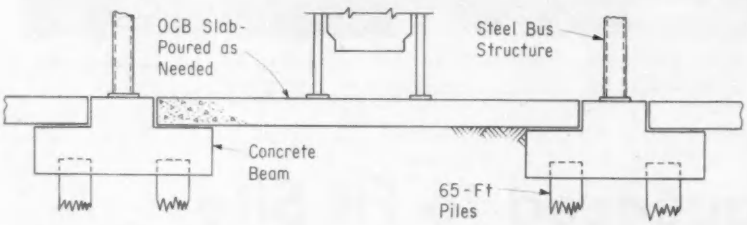
Although the substation was designed for 23 kv, the transformers —pending further study—have 13.8-kv secondaries, and the network feeders operate at that voltage also. Structures, transformers, and circuit breakers are on wood-pile-supported foundations, 187 65-ft creosoted pilings going down to a dense sand stratum to support a working load of 15 tons each.

Steel-reinforced concrete pile caps were poured, frequently integrally with the breaker or structure foundation. Galvanized steel structures support buses and disconnect switches.

Most electrical buses are 6061-T6 aluminum tubing. The 13.8-kv



LOW-VOLTAGE BUSES are 2½-in. IPS extra-heavy aluminum tubing and the cable leads to disconnect switches are saddle-type compression connectors



CREOSOTED PILINGS, 65 ft long, were driven to dense sand to support foundations for the substation's outdoor structures, transformers, and circuit breakers

bus is 2½-in. IPS extra heavy, selected for current-carrying capacity, and the 115-kv bus 3½ in. IPS, for avoiding excessive deflection. Cable leads tapped from the bus have saddle-type compression connectors welded to the bus. A complete bus was raised and placed in position on aluminum-bus support clamps designed to accept it, and the bus was aligned and the adjacent support clamp section installed.

The only welding above grade is that between major tubing tap connections. Thermit welding was used for bus cable-to-cable taps as well as for all grounding system connections. Bolted connections were used at switches, transformers, and circuit breakers to facilitate their disconnection, but minimized elsewhere.

The 13.8-kv structure foundations support the breaker slab too, so that feeders can be added without the driving of piling next to an energized bus.

The control house has brick walls on a pile-supported concrete slab and a ceiling of precast concrete beams supporting an insulated built-up roof covered with marble chips. Air conditioners maintain an even temperature and uncontaminated atmosphere for the operation of the relays and the instruments.

Two Panels Added

To facilitate operation and reduce on-site assembly of contactors, distribution panels, battery chargers, meters, and similar components, two auxiliary panels were fitted in line with other control panels. The dc auxiliary panel has two battery chargers with indicating instruments, dc distribution circuit switches, and radio and recording-meter inverters. The ac auxiliary panel has bus-voltage recording meters, a transformer temperature recorder, all switches for 208/120-v auxiliary circuits and lighting contactors.

Plastic conduit, concrete cable trenches, and flexible, PVC-sheathed metallic conduit were used extensively for control circuits. All control cables are 19/22 multi-conductor having nylon over polyethylene insulation and polyvinyl-chloride sheath. All connections have pre-insulated compression terminals.

Transmission lines to the substation are relayed by pilot wire relays backed with impedance phase relays and product-type ground relays. Differential relays protect transformers and, as these at this time have no high-voltage breakers, cause an automatic ground switch to close. Such closure trips the remote transmission-line breakers.

Allows Reclosure

Simultaneously a disconnect switch is tripped automatically and opens immediately after the ground switch has closed. This action isolates a faulted transformer as well as the closed ground switch and allows the line to be reclosed. As backup for the transformer differential relays, there are overcurrent relays fed from current transformers in the transformer 115-kv bushings. The CT's also trip the ground switch and 115-kv disconnect switch.

A study is in progress to determine the breaker type to be used with the transformer 115-kv circuit breakers. Various mechanisms for circuit interruption in oil, gas, air, or vacuum are under consideration.

The 13.8-kv bus is protected by Type PVD relays operating from CT's in the breakers of a bus section. The transformer 13.8-kv breaker and tie breaker are tripped for a bus differential relay operation. Overcurrent relays in the transformer 13.8-kv breaker CT circuit operate as backup for the bus differential relays.

Feeder relaying is obtained with overcurrent relays in each phase and in the ground connection.

British Build Mine-Mouth Plant

600-Mw power plant nearing completion at Rugeley, England, will be mine-mouth operation, involves both National Coal Board and CEGB

J. H. M. SYKES, Overseas Correspondent, London, England

At Rugeley, Staffordshire, England, a combined power plant-coal mine project, now being completed, points to the benefits being obtained from collaboration between the National Coal Board and the Central Electricity Generating Board.

The 600-Mw power plant contains five 120-Mw generating units using steam at 1,600 psi, 1,010F. The first unit will be commissioned in late 1960; the fifth in 1964.

Main feature of this power plant is a direct connection with the mine which comprises a highly mechanized two-shaft, 1,200-ft deep pit. Battery-operated locomotives bring the coal direct to the pit bottom from the conveyors attached to the coal cutting machines. Other conveyors at the top carry the coal through the preparation plant and on to the power station.

The two 30-in. belt conveyors from the colliery can deliver 300 tons per hr each.

Schedule to Operate This Year

The mine will be operative this year and will supply about 850,000 tons of coal a year to the power station. This represents about half the station's ultimate requirements. The coal will have a calorific value of 9,500 Btu per lb, and 17% ash, 15% moisture. Present price is 45.7¢ per million Btu. Coal for the station in excess of the mine's production will come in from other pits, through the colliery sorting and preparation plant.

The station is designed for an overall thermal efficiency of 34.5% and will have a total plant cost of 0.48¢ per kwhr differing from the others. The generator will have water as well as hydrogen cooling at 30 psi. The cooling tower for this unit will be of the "dry" type, with the water passing through aluminum-finned radiators mounted around the base of the tower. Natural circulation through the concrete, hourglass-shaped tower provides the necessary cooling air circulation. At 350 ft high, with a 325-ft base dia, this will be the largest cooling tower in the world.

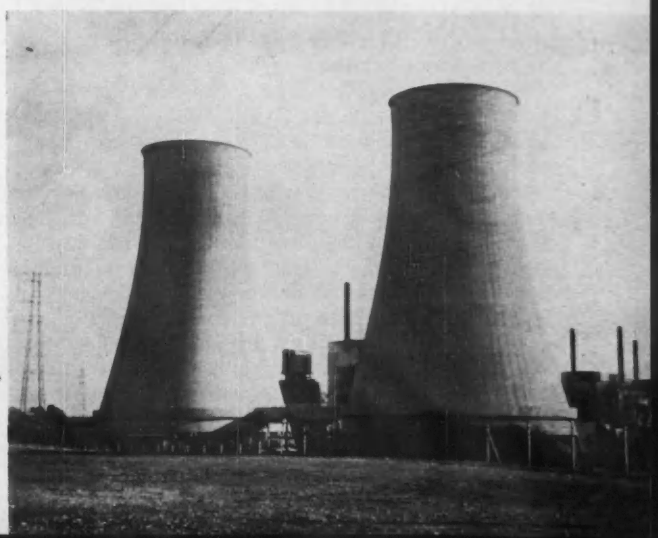
Another unusual feature at Rugeley is the totally enclosed, brick-built 132-kv switchyard. Station buildings are of brick construction up to 39 ft above ground. Above this level 200,000 sq ft of aluminum sheeting completes the cladding. The two ferro-concrete brick-lined stacks are each 450 ft high.

Although it does not employ advanced steam conditions, the Rugeley station will have a high place in the central control room's "league table" of economic outputs, as fuel transportation costs are almost negligible. Co-ordinated planning is ensuring that as the five generating units come into commission the mine's output will increase to meet the demand.

CEGB to Install Supercritical Units

While Rugeley exhibits features of special interest which are mainly concerned with broad planning, the recent decision to install two 375-Mw supercritical units at the "C" extension of the Drakelow Station, Burton-on-Trent, is a technical advance. The two units, one to be made by Associated Electrical Industries and the other by English Electric, will have turbine-stop valve conditions of 3,500 psi and 1,100F, with reheat to 1,050F. When commissioned in 1965, the station will include two boilers, one by Babcock & Wilcox and the other by International Combustion.

Both turbine units will be of the in-line, tandem-compound design, running at 3,000 rpm. The AEI turbine will have a high-pressure, intermediate-pressure, and two low-pressure cylinders. There will be a double flow from the LP cylinders exhausting into the twin condensers. The English Electric turbine has a double casing for the HP cylinder for the early stages, the expanded steam being made to pass over the outside of the inner casing on its way to the remaining stages. There is a partial double casing on the IP cylinder, and a quadruple-flow LP cylinder. The last blade will have an effective length of 36 in.



RUGELEY STATION, Staffordshire, England, has three cooling towers, two of which are shown in the photo. The third tower is the new dry type mentioned in the preceding text

Overhead Raised From 4.16 to

Changeover by Georgia Power relieves overloaded substation without failure

W. L. WESTBROOK, Atlanta Division Manager, Georgia Power Co, Atlanta, Ga.

Overhead distribution at 19.8 kv has operated since last December in the Buckhead area of Atlanta, Ga., without lightning arrester failure or blown fuse. The heavy overloading of a substation formerly distributing power at 4.16 kv prompted Georgia Power Co's conversion to this voltage.

Load growth, complicated by a scarcity of substation sites close enough to load centers to permit 4.16-kv distribution, turned the utility first to considering 12.47-kv distribution. As a consequence, the Atlanta area has 26 substations and 35 feeders supplying that voltage in addition to its 69 substations and 176 feeders at 4.16 kv.

But industrial loads and motor-starting currents in several areas served at 4.16 kv produced intolerable voltage drops, for which conversion to 12.47 kv would give only temporary relief. But such relief would be at a cost too great for a merely transitional expedient.

The company has used some 19.8-kv distribution and found it very satisfactory over the past 12 years. This use, however, was confined to a rural area in the Valcosta division, where conversion was not from 4.16 kv but from 12.5 kv.

Wherever it has been installed, 19.8-kv overhead has been a grounded-neutral wye system, without the neutrals and without regulation. Once it was decided to use a 19.8-kv distribution system in the Buckhead area, Georgia Power set up a program for installing both neutrals and regulators at all 110 to 19.8-kv substations.

Most of Georgia Power's reluctance to go to distribution voltages higher than 4.16 kv is associated with the change from rubber gloves to hot sticks in the installation process. Line crews had limited experience with the sticks in maintenance of distribution lines.

When the Buckhead area 4.16-kv substation and feeders became excessively loaded, the few routes leaving the substation were already congested with equipment. Enlarging the substation or adding new feeders would have been very expensive. A suitable lot for another substation was not only priced too high, but its acquisition would involve the company in zoning difficulties. Furthermore, Georgia Power was mindful that the area is a potentially underground one, so that any immediate solution to present voltage problems could not afford to disregard this further possibility.

Georgia Power expects several new loads in the area that would require transformer vaults. Were the transformers connected to a 19.8-kv overhead system at the time of installation, their incorporation in the underground system at the same voltage would be easier.

For many years the Atlanta area has had a 19.8-kv subtransmission system, part of which supplied four underground networks and another part a very extensive overhead system to most of the company's industrial loads and distribution substations where both 4.16 and 12.47-kv distribution circuits originate. This substation has been severely taxed recently, despite additional 110 and 19.8-kv substations integrated with it. Thus part of it has been converted gradually to 44 kv, particularly in fringe areas where many industrial loads are now developing.

Although overhead transmission at 19.8 kv seems to be on the way out, that voltage in an underground system will probably remain. As 19.8-kv overhead lines were overbuilt on many 4.16-kv lines and are reasonably available to lines in the 4.16-kv area, the company felt the higher voltage would be suitable for a distribution system.

Before designing such a system for the Buckhead area, Georgia Power engineers drew heavily on the higher-voltage experience of sister companies in the Southeastern Electric Exchange. Carolina Power & Light Co and Duke Power Co were most helpful in important decisions, especially through their reports on BIL's, switching arrangements, lightning protection, fusing, pole spacing, and transformer installations.

19.8-Kv Primary Is Looped

Georgia Power found that it would have to use poles higher than the original ones for the 4-kv system, so that the 19.8-kv primary could be strung and the transformers installed safely before starting the cutover. Cutting-over began at the end of the 4-kv feeders. As load was shifted to the 19.8-kv system, the 4-kv circuits were torn down, their poles being left standing. Tearing down the older distribution system reduced the hazards to linemen climbing through one system to another.

As the Buckhead area is considered critical as far as service is concerned, the 19.8-kv primary was looped and many sectionalizing switches were placed in it. Most of these are single-pole, stick-operated, but enough gang-operated switches were installed to take care of any load-interrupting duty that might be anticipated.

The conductor is 4/0 bare ACSR, the crossarms 5 x 5 x 8 in. creosoted pine, and there is a pole top pin. Cutouts are rated at 27 kv and have load-interrupting attachments. The lightning arresters are rated at 15 kv. Transformers are rated 12,000/20,800 v to 120/240 v with four 2½% taps down and a BIL rating of 125 kv.

When, about 35 years ago, the 19.8-kv system was begun by wye connecting an 11-kv delta system, many

19.8 Kv

substation transformers of 11-kv rating and 15-kv insulation continued in use in wye-connected banks. There were many failures on the transformers of that period, so that over the years all substation transformers were changed to 150-kv BIL.

The areas now being converted to 19.8-kv distribution are not rural ones; they are the most important and highest-load-density areas still supplied by overhead distribution. Accordingly, there was reluctance to supply the areas with 95-kv BIL equipment which would be connected also to the same lines as the 150-kv BIL substation equipment.

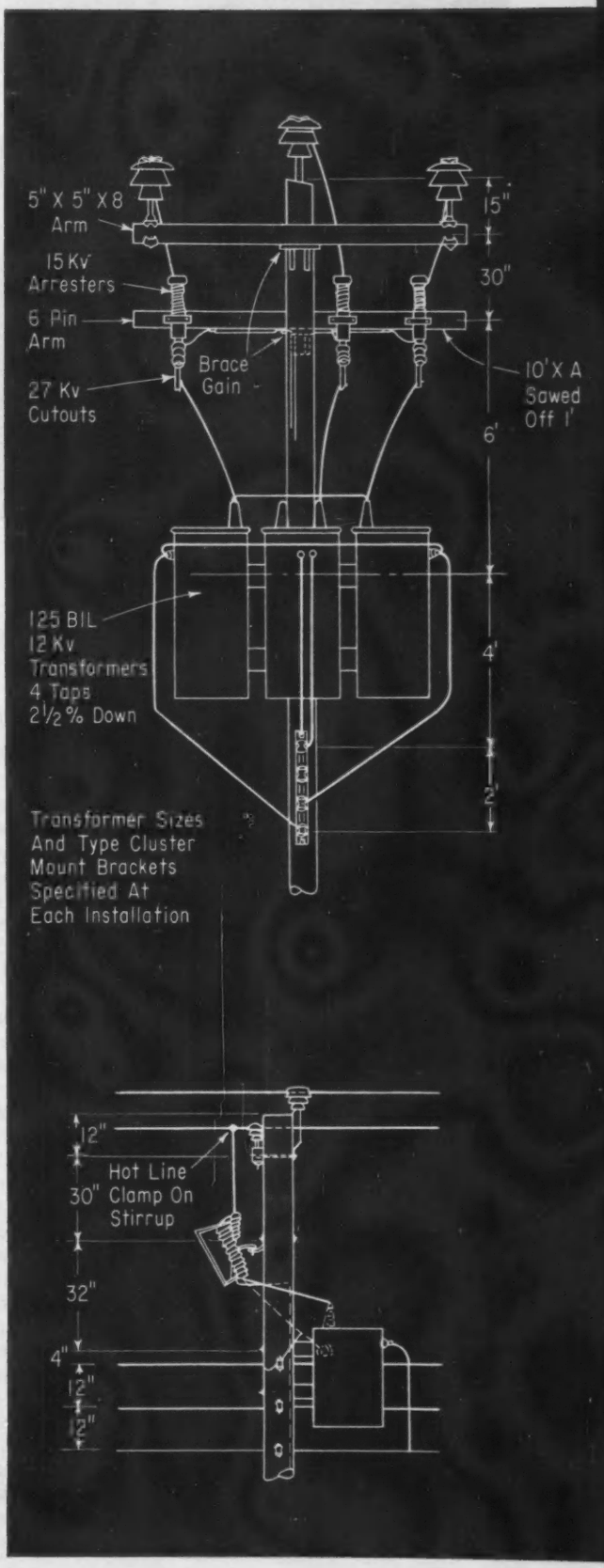
Transformer Standard C57.12.20 (1959) shows that 95-kv BIL is not standard for use on line-to-line voltages above 14.4 kv. The standard transformer for 14,400/24,940-v grounded wye is 125-kv BIL, but the tap range in this transformer was too high for Georgia Power's use. In effect, the company was buying this transformer for 12,000/20,800-v grounded wye with taps below normal. Underground transformers, many for the same lines, are 125-kv BIL.

4-Kv Neutrals Serve for Time

Cutover of this system was started on April 20, 1959, and finished on December 11, 1959. Conversion was started before the 19.8-kv neutrals were completed, but the 4-kv neutrals were adequate temporarily. As most of the transformers were in banks of three with a minimum of unbalance, unbalanced currents gave no trouble.

The 19.8-kv distribution will be readily available wherever its use will keep loads on the 4-kv system down to what can be carried on existing facilities. Where retention of the 4-kv system is desirable, loads from 150 to 500 kva will probably be handled by cluster-mounted single-pole installations. Larger loads will be handled by grounded type substations or transformer vaults.

Where these installations are connected to the 19.8-kv system, every effort will be made to keep them from adding undue exposure to those lines since they are still the main subtransmission lines in many areas and have many large industrial customers' substations tapped to them. This accounts for the use of plenty of insulation and special attention to grounding, switching, and clearances. In converted areas series street lighting will be changed to multiple lighting.



TRANSFORMERS for 19.8 kv included 3-phase cluster-mounted units shown above and single-phase units like the one below. In mounting the latter on the pole's side the polyethelene-covered riser goes uncut through arrester terminal to cutout

SPEAKERS included K. J. Bossart (left) Convair-Astronautics. With him are shown J. F. Sinnott, meeting chairman, and C. H. Linder, president of AIEE

AIEE Told Direct Conversion

Engineers hear aero-space technologists on MHD, materials, cesium cell; substations featured in San Diego talks

Direct conversion of heat to electricity, a development with implications as revolutionary as nuclear energy for the electrical utility industry, is nearing the practical stage with the fresh impetus now given it by a flight technology.

Thus the American Institute of Electrical Engineers was told at its recent Pacific Coast General Meeting. The AIEE met jointly with the Aero-Space Transportation Conference at San Diego, Calif.

The growth of space-flight technology will aid not only research in direct conversion, including magnetohydrodynamics (MHD), but also the search for materials suitable for today's higher temperatures and molecular electronics, generally, said K.J. Bossart, Convair-Astronautics.

General Atomic Division, General Dynamics Corp, has produced 90 w of electricity from a cesium cell, heated by nuclear energy (EW, Aug. 22, p 47). This took place at the company's La Jolla laboratory, where the cell had been placed in the bottom of a fuel element housing in the Triga experimental reactor. Those engaged described the work, which is supported by investor-owned utilities.

Characterizing the cesium plasma cell as one of the most promising direct-conversion methods, Dr W. B. Teutsch described the method as one based on the Edison effect: Electrons are boiled out of a hot plate and collected on a cold one.

A small amount of cesium vapor added to the cell becomes an ionized gas, or plasma, which allows current to pass more readily. An efficiency approaching Carnot's can be exhibited when radiation and other irreversible effects are neglected, Teutsch averred.

H. L. Garvin pointed out that the electrical output current of cesium cells, though primarily dc, undergoes oscillations in the order of 100 kc under certain conditions. Recent GA experiments have related the output current characteristics to cell parameters, providing data for design of operational conversion equipment.

Nuclear heat, Garvin said, circumvents materials-compatibility problems associated with chemical sources at high temperatures and allows the use of maximum geometrics for minimizing heat losses.

The first direct-conversion reactor plants will probably be developed for space and marine applications, said GA's R. C. Howard, adding that central station plants will follow.

A combined system holding the possibility of overall energy conversion efficiencies in excess of 50% was suggested by Republic Aviation's A. Schock. He noted that the plasma diode system has been reported to have achieved efficiencies of 10 to 15% in small laboratory devices and offers the theoretical possibility of 35% efficiency.

Sees Rejected Heat Used

Yet, because of the high heat-source temperature (2,000 to 3,000F), it is possible, he said, to attain good efficiency with a relatively high heat-sink temperature (700F). Accordingly, it may be possible to use heat rejected by the thermionic unit to generate power by using a steam turbogenerator or thermoelectric elements.

Renewal of studies of semi-conductor materials has spurred progress toward thermoelectric all-year air conditioning, said M. A. Fuller, Whirlpool Corp. A thermoelectric system, he said, would utilize the Peltier effect in a heat pump having

P. W. **KIESLING** (left) described PS of Colorado's single-circuit, integral substations. With him are W. L. Kelly, GE, and O. R. Buckley, SoCal Edison Co

Gains From Space-Flight Studies

ceiling plates exposed to radiant heat transfer.

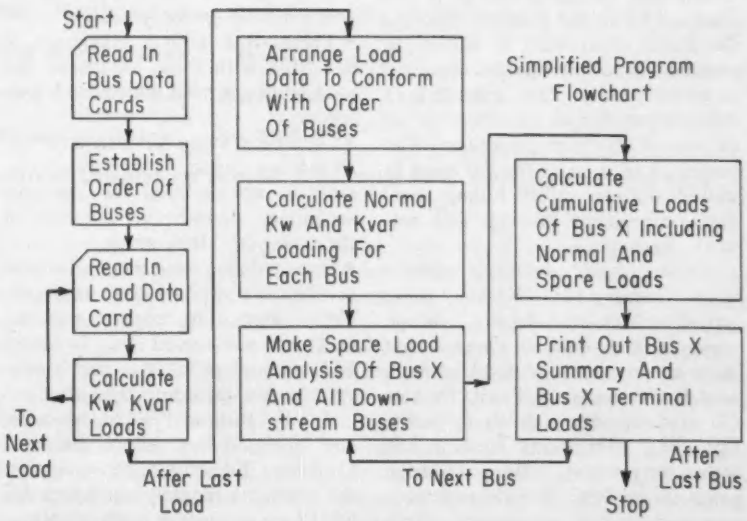
The multi-zone concept of comfort-conditioning of larger buildings by small package units is an important trend in heat-pump application, said D. J. Slack, General Electric Co, who cited these factors favoring the concept:

- Zone-to-zone temperatures are easily maintained by a simple control system.
- In a mechanical failure, the plant is not affected.
- There is no requirement for boiler plant, stack, or other large equipment space.
- Small duct work is low in cost.
- There is less need for step starting.
- No stand-by losses on unloaded or lightly loaded components.
- Operating personnel are not needed.
- Maintenance is simple.
- The permissible amortization period is shorter with respect to taxes.
- There is greater flexibility in the rearrangement of conditioned spaces.

A study of a Los Angeles office building led to abandonment of the installed steam radiator system in favor of 310 1-ton heat pumps in radiator locations. This system was installed for $450,000 of which about $150,000 was for electrical wiring. The estimated cost of a conventional central-plant heat-pump system was $2,350,000. Actual operating cost of the system is 1¢ per hr per ton including cooling, heating, circulation, and filtration.

Distributing high frequencies over wide areas of buildings and industrial plants to supply high-frequency fluorescent lighting presents no major obstacles, said J. N. Robertson, Los Angeles Department of Water & Power. A conservative design using good material and equipment based on 60-cps technology should be quite satisfactory, he said.

(*Continued on next page*)


Start
Read In Bus Data Cards
Establish Order Of Buses
Read In Load Data Card
Calculate Kw Kvar Loads
To Next Load
After Last Load
Arrange Load Data To Conform With Order Of Buses
Calculate Normal Kw And Kvar Loading For Each Bus
Make Spare Load Analysis Of Bus X And All Downstream Buses
To Next Bus
Simplified Program Flowchart
Calculate Cumulative Loads Of Bus X Including Normal And Spare Loads
Print Out Bus X Summary And Bus X Terminal Loads
After Last Bus
Stop

PROGRAM for Burroughs 205 can handle 1,000 buses and loads, each bus with 7 Feed-To, 3 Feed-From circuits. A load can serve as common spare for 9 loads

Wire and cable must be derated because higher frequencies increase the effective resistance and reactance of circuits and the effect of magnetic materials on reactance heating of wire and cable. But the effect can be ignored usually on branch circuits carrying up to 20-amp load with good power factor. Robertson suggested for larger circuits the use of stranded conductors, non-magnetic conduit or raceway, close conductor spacings, and equalized lead lengths on circuits fed from the same power supply. He cautioned that wiring carrying high frequency not be placed in the same enclosures with those carrying 60-cps power because of the distortion produced by 60-cps on wave shapes of higher frequencies. But special shielding is not usually necessary to avoid interference with communication equipment.

Most power sources commerically available for supplying lighting systems are either magnetic multipliers or ordinary frequency changers. Electronic frequency changers, particularly transistorized devices, are under development.

Updates Load Data

A digital computer program has been developed to simplify calculating, summarizing, and updating electrical load information for large industrial power systems, said C. W. Boice and D. E. McCall, C. F. Braun & Co. It also provides a means for improving results.

The use of the program is not confined to initial plant design. As the basic input data is stored on punched cards, it can be up-dated or revised easily. Thus, current load information can be obtained for all or part of an electrical system. The output is in a form readily used in power studies, utility billing forecasts, equipment loading, and network analysis.

Single-circuit, integral substations, rated 115/13.8-kv, serve initially low-load-density fringe areas in metropolitan Denver that have a slow rate of load growth, said P. W. Kiesling, Public Service Co of Colorado, and W. L. Kelly, GE. The substations have a low initial investment. Present design practices of PSC provide a flexible arrangement of component parts, utilizing either integral or conventional type units, for ultimate expansion. Either expansion utilizes the major portion of the original installation, resulting in a minimum abandonment of substation facilities and loss of capital investment.

R. N. Southgate, Public Service Electric & Gas Co, commented that the approach is novel in that it extends to the 115-kv system the use of single-circuit, integral-type, unit substations which many utilities use on lower-voltage systems. He pointed out that consideration must be given to the timing of changeover to a conventional arrangement as load grows to obviate an excessive floating supply of system units.

R. W. Jenkins, Baltimore Gas & Electric Co, said that his company is beginning to use 13-kv distribution. As Southgate's presentation stated that a second transformer was not installed until needed by load at any one location, Jenkins inquired what happens when a transformer fails. Kiesling replied that a mobile substation gives back-up service.

A paper on single-feeder substations in the Wichita area by E. G. Karsten, recently deceased, Kansas Gas & Electric Co, was presented by H. Fossum, Pioneer Service & Engineering Co, who was recently elected chairman of the AIEE Substation Committee. Starting in 1954, KG&E now has 24 single-feeder substations with a total of 152.5 Mva, self-cooled capacity, in 5 and 7.5-Mva units. Their use has these advantages:

- Installation costs are low.
- Units are so small they can be protected by primary fusing.
- These sizes, with a maximum of 9.3 Mva with fans, are about the maximum carried on a 12.5-kv feeder.
- Obtaining fuses of adequate interrupting capacity for lateral circuits is no problem for the rms secondary short-circuit currents in the order of 5,000 amps.
- Standardizing has made the cost comparable with larger multiple-circuit units. The average installed cost per self-cooled kva is about $11, without primary circuit breakers and not including land cost.

O. R. Bulkley, R. S. Melville, and N. E. Weber, all of Southern California Edison Co, reported that the company recently constructed a 66/12-kv substation using all-aluminum rack structures and aluminum conductors and fittings. Design and construction experience showed that the cost savings possible from using aluminum for buses and conductors are significant, and that the aluminum structural racks appears to be satisfactory. Installed cost is not yet competitive with steel.

Talbert Substation was constructed last year when the range of bids for fabricated aluminum structures varied from 60¢ to $1.25 per lb. Prices on similar substation structures in 1960 revealed a low bid of 95¢ per lb, an increase of about 54% over the previous low figure. H. M. Manning, Tacoma City Light, commented that bids were being received by his organization at about 72¢ per lb.

Phasing Revised

Southern California Edison Co has adopted a new phasing convention to designate buses and transformer leads ABC from upper left to lower right, conforming with terminals of the 3-phase transformer without reference to the compass. In this way, the entire station can be oriented in any direction with no change in bus connections or phase markings on the drawings, said O. R. Bulkley. The phasing convention has been adopted for design of new stations in which 220 and 66-kv transmission lines arrive at the station with conductors in vertical configuration.

Significant design cost savings are anticipated as a result of greater repetitive use of standard designs. In addition, the 3-phase transformer can be substituted for a bank of three single-phase transformers when load increases, without change in bus taps or current-transformer secondaries and without the bus taps being unsymmetrical in the 3-phase transformer positions with respect to the rest of the station.

A computer program has been developed for accurate, fast determination of whether fault duties are approaching ratings of system circuit breaker, said M. J. Lantz, BPA. Punch cards listing 3-phase and single-phase-to-ground-bus faults for every bus are sorted against those listing each breaker's ratings. The program provides a list of all breakers suspected of having their rating approached or exceeded. These are run through a second program to determine the actual fault duty

(*Continued on page* 182)

11th annual electrical industry FORECAST

1960 1980

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Production, Peak Loads, and Capacity Additions . . . p 108

Residential Kwhr Sales . . . p 110

Commercial and "Other" Kwhr Sales . . . p 114

Industrial Kwhr Sales . . . p 115

Comparison of Electrical World, EEI, and FPC Forecasts . . . p 118

Arthur J. Stegeman
Manager,
Market Research

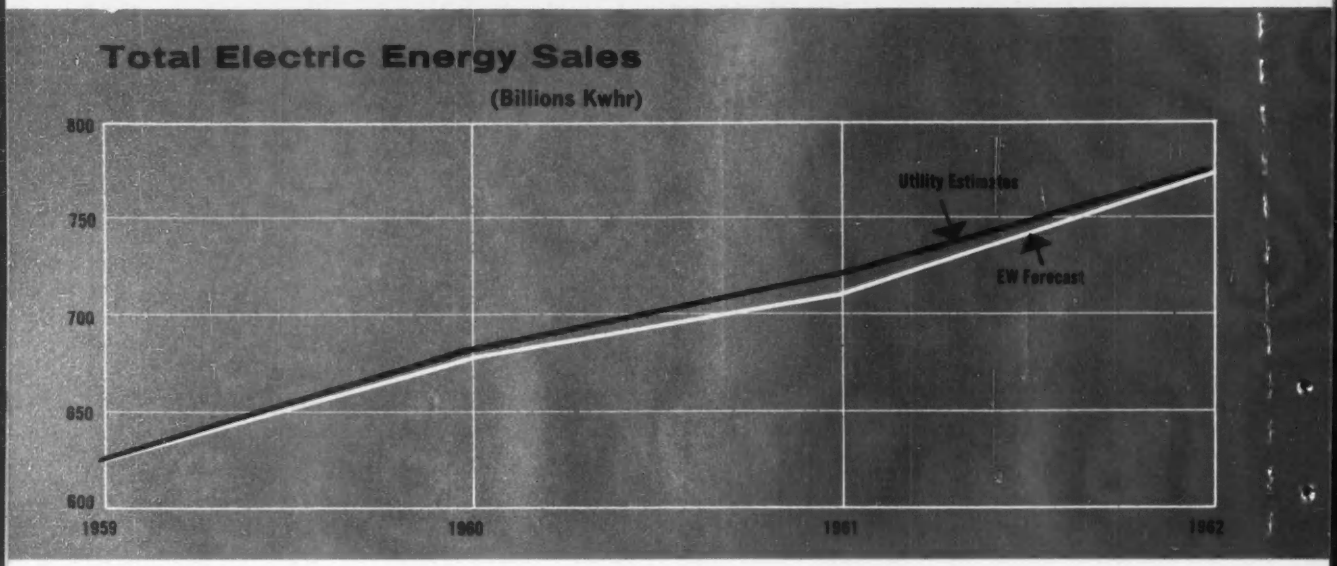
a special report

This forecast is loaded with changes. They result from the constant turbulence in our economy and from changes in the character and composition of the electric utility industry itself.

Additional changes result from improvements in statistical techniques and should be noted carefully. The most important are a new series on housing starts by Bureau of Census and a revision of commercial and industrial kwhr sales data by Edison Electric Institute.

Detailed analysis reveals these changes have little effect on our previous forecasts. They did revise some figures and in certain cases caused shifts in timing and estimates of kwhr sales to various customer classes. And quite naturally, many of these forecast changes are more pronounced for the years immediately ahead due to events of the past year.

But, all in all, nothing has diminished the industry's growth potential. The challenge of achieving these goals remains, along with the myriad problems entailed in plant expansion to meet future loads.



Utilities See Kwhr Sales Up 24.0% by 1962

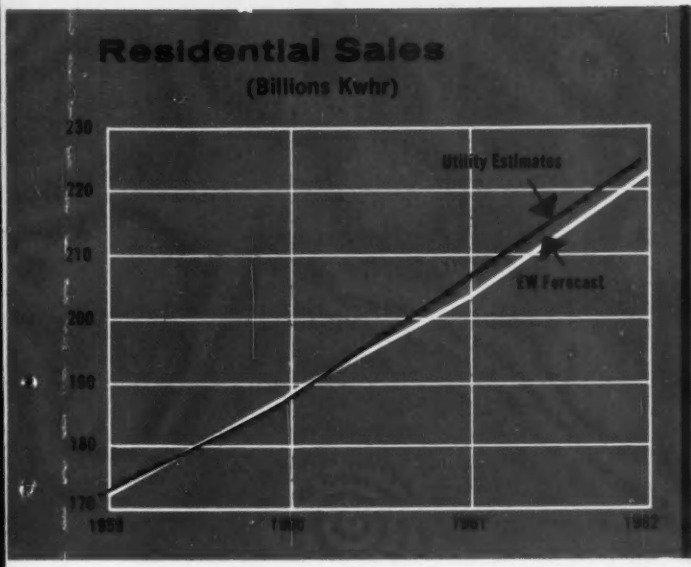
Individual estimates from the nation's electric utilities indicate that while collectively they are in general agreement with Electrical World's short-range industry projections on the following pages, they are somewhat more optimistic than EW. These results are based on an Electrical World survey made in early August. Replies were obtained from 164 utilities representing 84% of the industry's customers and 79% of the generating capability.

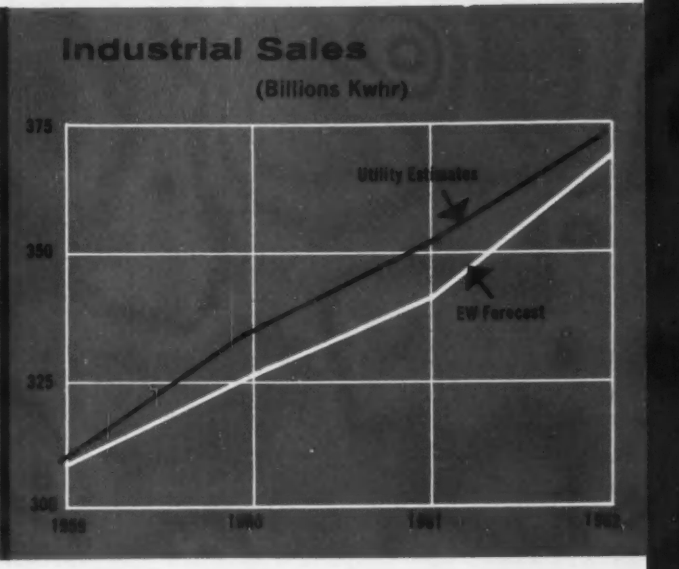
Utilities anticipate a 1960 increase of 7.5% in total energy sales to 673.7 billion kwhr compared with EW's forecast of 670.9 billion kwhr—a 7.1% increase. The greatest difference appears in 1961 when utilities estimate sales at 723.4 billion kwhr—

Industry Estimates of Kwhr Sales: 1960-1962

(Billions of Kwhr)

	Residential	Industrial	Commercial	"Other"	Total
New England					
1959	8.6	11.1	4.1	0.9	24.7
1960	9.3	11.7	4.4	1.0	26.4
1961	10.0	12.1	4.8	1.0	27.9
1962	10.7	12.6	5.1	1.2	29.6
Middle Atlantic					
1959	27.3	46.4	17.3	7.0	98.0
1960	29.0	49.1	18.1	8.2	104.4
1961	30.9	51.3	19.3	8.5	110.0
1962	33.0	54.5	20.6	8.8	116.9
East North Central					
1959	35.2	75.2	21.2	8.0	139.6
1960	37.5	79.5	22.3	8.5	147.8
1961	40.4	83.0	23.9	9.2	156.5
1962	43.7	86.7	25.7	9.8	165.9
West North Central					
1959	14.7	12.6	8.2	2.7	38.2
1960	15.8	13.7	8.8	2.9	41.2
1961	17.2	14.5	9.4	3.1	44.2
1962	18.6	15.6	10.0	3.2	47.4
South Atlantic					
1959	25.6	33.8	14.9	3.5	77.8
1960	28.3	36.5	16.4	3.9	85.1
1961	31.3	39.3	18.0	4.2	92.8
1962	34.5	42.8	19.8	4.6	101.7





vs Electrical World's Estimate of 23.5% Gain

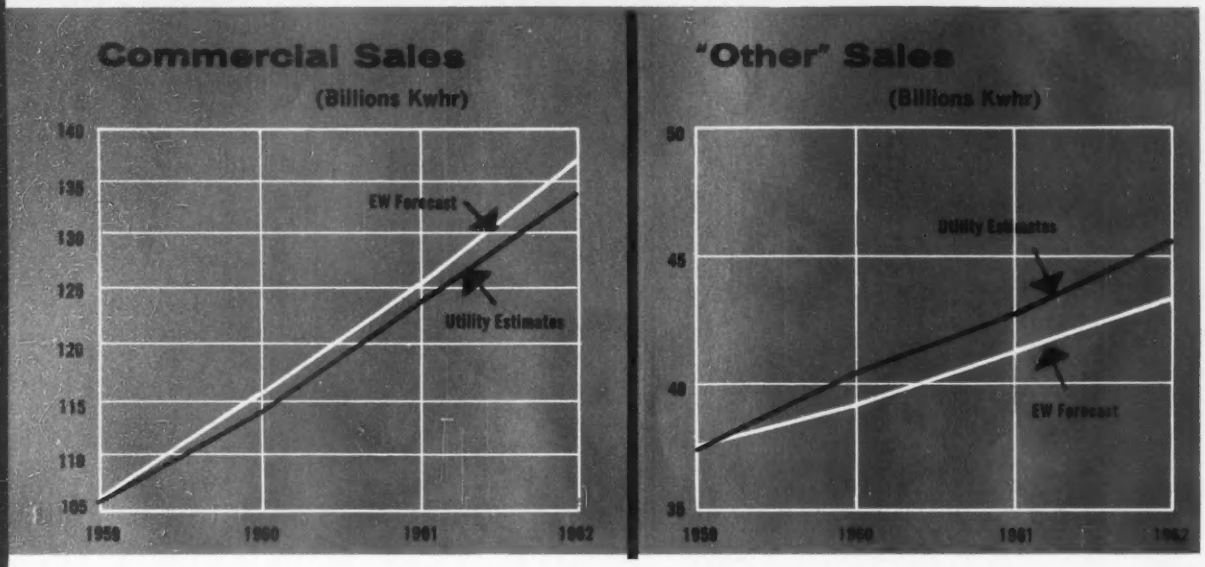
15.4% over 1959 and EW indicates 712 billion kwhr —13.6% over 1959. In the third year, 1962, the forecasts come closer. Company forecasts see sales at 777.2 billion kwhr as against EW's 773.9. These represent gains of 24.0% and 23.5% respectively over 1959.

Sales forecasts for individual customer classifications pinpoint the reasons for these differences. There is almost complete agreement on residential sales. Utilities estimate gains over 1959 at 8.7% in 1960, 18.5% in 1961 and 29.1% in 1962. EW increases are 9.2%, 18.2% and 28.6%

Industrial sales account for the main difference between the two forecasts. Utilities apparently are

—Based on Individual Utility Reports to Electrical World

	(Billions of Kwhr)				
	Residential	Industrial	Commercial	"Other"	Total
East South Central					
1959	15.8	60.8	6.0	1.5	84.1
1960	17.8	64.8	6.6	1.6	90.8
1961	19.6	68.5	7.2	1.6	96.9
1962	22.0	71.8	7.8	1.7	103.3
West South Central					
1959	14.2	22.4	11.4	3.6	51.6
1960	15.9	23.5	12.4	4.2	56.0
1961	17.8	26.9	13.5	4.5	62.7
1962	19.8	29.3	14.7	4.9	68.7
Mountain					
1959	7.5	10.6	5.9	1.9	25.9
1960	8.2	12.2	6.5	2.0	28.9
1961	8.8	13.2	7.1	2.2	31.3
1962	9.6	14.9	7.8	2.4	34.7
Pacific					
1959	24.6	36.0	17.6	8.6	86.8
1960	26.8	38.9	19.2	8.6	93.5
1961	29.2	41.9	20.9	8.9	100.9
1962	31.9	45.1	22.8	9.2	109.0
Total Contiguous U. S.					
1959	173.4	308.8	106.7	37.8	626.7
1960	188.5	329.8	114.6	40.8	673.7
1961	205.4	350.8	124.1	43.1	723.4
1962	223.9	373.4	134.2	45.7	777.2



more optimistic about the economic outlook, particularly for 1961. They expect industrial sales to exceed 1959 by 6.8% in 1960, 13.6% in 1961 and 20.9% by 1962. Electrical World's forecast on the other hand indicates gains of 5.6% in 1960, 10.1% by 1961 and 19.9% by 1962. The utilities' 1962 target is 373.4 billion kwhr as compared with EW's 370.2 billion kwhr.

Further, self-compensating disagreements show up in forecasts for commercial and "other" sales. The utility forecast anticipates commercial sales gains over 1959 as 7.4% in 1960, 16.3% by 1961 and 25.8% by 1962. EW's forecast is for increases of 8.5% in 1960, 17.8% by 1961 and 28.8% by 1962. The net results are 1962 commercial sales estimates of 134.2 billion kwhr by utilities and 137.4 billion kwhr by EW.

Electric companies anticipate a three-year boost of 20.9% for "other" sales putting the 1962 total at 45.7 billion kwhr while EW's forecast indicates a 14.6% increase to 43.3 billion kwhr.

Top honors for fastest growth are split almost evenly between West South Central and Mountain regions. WSC with 8.2% of 1959 industry sales expects a 33.1% gain by 1962 and Mountain with only 4.1% of '59 sales anticipates a gain of 34%. Next in line is South Atlantic with 30.7% followed by the Pacific with 25.6%. Trailing the pack with 22.3% of total 1959 sales is the East North Central region with an 18.8% gain.

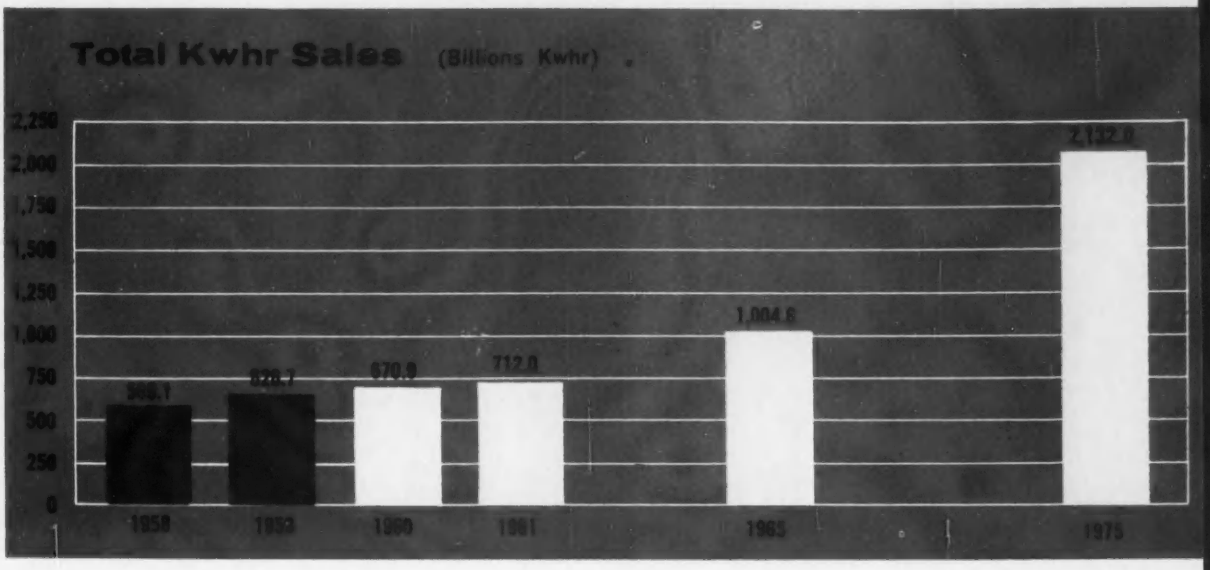
Electric Utility Estimates vs Electrical World Forecast

(Billions Kwhr)

	Residential		Industrial		Commercial		"Other"		Total	
	Utility	EW	Utility	EW	Utility	EW	Utility	EW	Utility	EW
1959	173.4		308.8		106.7		37.8		626.7	
1960	188.5	189.3	329.8	326.2	114.6	115.8	40.8	39.6	673.7	670.9
1961	205.4	205.0	350.8	340.0	124.1	125.7	43.1	41.3	723.4	712.0
1962	223.9	223.0	373.4	370.2	134.2	137.4	45.7	43.3	777.2	773.9

Coverage of Electrical World's 1960 Forecast Survey

No. of Utilities Reporting	% of Industry Customers	% of Industry Generating Capability
164	78.6%	83.6%



EW Sees 7.1% Sales Gain in 1960

Total utility sales of electric energy are expected to hit 670.9 billion kwhr in 1960—7.1% over 1959's 626.7 billion kwhr. Next year a moderate gain of 6.1% should put the annual total at 712 billion kwhr. The economic factors supporting these estimates are detailed on the following pages.

Based on forecasts by the McGraw-Hill Department of Economics, *Electrical World's* utility forecast indicates 1980 energy sales will be 347% over last year at 2.8 trillion kwhr.

Residential sales will rack up a 9.2% gain in 1960 to hit 189.3 billion kwhr. By 1980 they will total 882 trillion kwhr—409% over '59.

Commercial sales should hit 115.8 billion kwhr in 1960—a gain of 8.5%. Next year's gain should be 8.5%. Between 1959 and 1980 commercial sales will jump 448% to about 585 billion kwhr.

Industrial sales should rack up a 5.6% gain during 1960 if the anticipated fall pick-up appears. Next year's gain is pegged at a modest 4.2% putting the total at 340 billion kwhr. A climb of 289% over 1959 will put 1980 sales of 1.2 trillion kwhr.

Total Electric Energy Sales

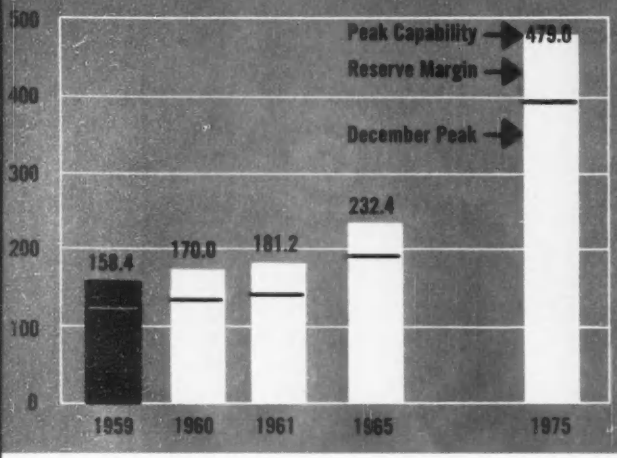
(Billions Kwhr)

	Residential		Industrial*		Commercial*		Other		Total
	Sales	% Total	Sales	% Total	Sales	% Total	Sales	% Total	Sales
1955.....	120.5	25.1	253.7	52.8	76.3	15.8	30.4	6.3	480.9
1956.....	133.9	25.3	281.5	53.1	82.9	15.6	31.9	6.0	530.1
1957.....	147.1	26.4	287.8	51.6	90.0	16.1	32.9	5.9	557.8
1958.....	159.0	27.9	280.2	49.2	96.0	16.9	33.9	6.0	569.2
1959.....	173.4	27.7	308.8	49.3	106.7	17.0	37.8	6.0	626.7
FORECAST									
1960.....	189.3	28.2	326.2	48.6	115.8	17.3	39.6	5.9	670.9
1961.....	205.0	28.8	340.0	47.7	125.7	17.7	41.3	5.8	712.0
1962.....	223.0	28.8	370.2	47.8	137.4	17.8	43.3	5.6	773.9
1963.....	242.0	28.7	405.3	48.0	151.4	17.9	45.7	5.4	844.4
1964.....	265.0	28.7	442.7	48.0	166.1	18.0	48.3	5.3	922.1
1965.....	289.0	28.8	482.2	48.0	182.2	18.1	51.2	5.1	1,004.6
1970.....	441.0	29.9	684.0	46.4	281.9	19.1	66.9	4.6	1,473.8
1975.....	660.0	31.0	952.4	44.7	433.0	20.3	86.6	4.0	2,132.0
1980.....	882.0	31.5	1,200.0	42.9	585.0	20.9	133.0	4.7	2,800.0

*Produced by Edison Electric Institute

Peak Loads & Capability

(Millions of Kw)



New Capacity Additions*

(Thousands of Kw)

	Thermal	Hydro	Nuclear	Total
1959	11,692	1,682	....	13,374
1960	9,735	1,575	325	11,635
1961	7,599	3,384	410	11,393
1962	9,520	1,484	268	11,272
1963	10,341	1,061	90	11,492
1964	12,244	1,100	300	13,644
1965	13,900	1,100	500	15,500
1970	19,812	1,100	2,500	23,412
1975	23,787	1,100	8,500	33,387

*Based on date of commercial operation.

Boosting Capability 74 Million Kw

Economic forecasts for year-end business activity indicate winter peak loads on the nation's major electric systems (Class I) should jump 9.0% to 133 million kw in 1960. A gain of 7.2% is predicted for 1961.

Generating capacity additions resulting from peak load growth should follow the pattern indicated in the table above. Additions through 1962 and part of '63 reflect orders already on the books.

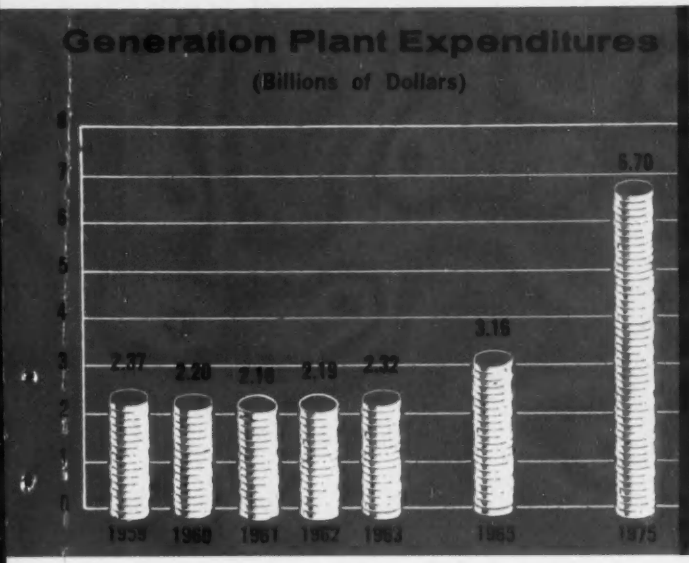
Despite a relatively high level of capacity additions, peak load growth will gradually cut the margin of reserve generating capacity from last year's high of 30.2%. The winter reserve margin should fall to 28.1% in 1960, 27.5% in 1961, 25.6% in 1962 and to the estimated ideal of 22.0% in 1963. This ideal reflects growing summer peak loads in many sections of the nation.

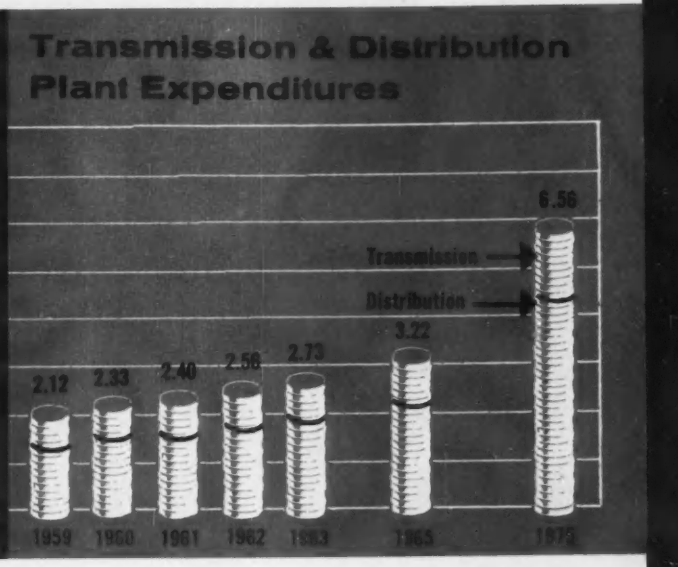
Electric utility construction expenditures should

Output, Peak Loads, Capability

	Output	Winter Non-Coincident Peak Load	Load Factor	Capability	Gross Margin
	billion kwhr	million kw	%	million kw	% Peak
1955	542.6	97.9	62.1	116.1	18.6
1956	597.2	102.4	66.4	122.6	19.7
1957	626.7	106.9	66.9	130.6	22.2
1958	641.1	113.4	64.5	144.2	27.1
1959	707.4	121.7	66.4	158.4	30.2
FORECAST					
1960	757.2	132.6	65.2	170.0	28.1
1961	804.0	142.1	64.6	181.2	27.5
1962	874.6	153.2	65.2	192.4	25.6
1963	955.0	167.0	65.3	203.7	22.0
1964	1,043.6	178.0	66.9	217.2	22.0
1965	1,137.6	190.5	68.2	232.4	22.0
1970	1,672.5	276.0	69.2	336.8	22.0
1975	2,422.8	392.6	70.4	479.0	22.0
1980	3,184.4	516.0	70.4	630.0	22.0

Data in this table is for Class I Systems. These operate about 97% of the nation's generating capacity.





by 1965 Will Cost $32.2 Billion

hover around $4.7 billion in 1960 and 1961—just slightly higher than last year's $4.67 billion. Spending should pick up to $4.9 billion in 1962 in anticipation of requirements during the mid-Sixties. By 1975, expenditures should hit $13.8 billion—195% over last year.

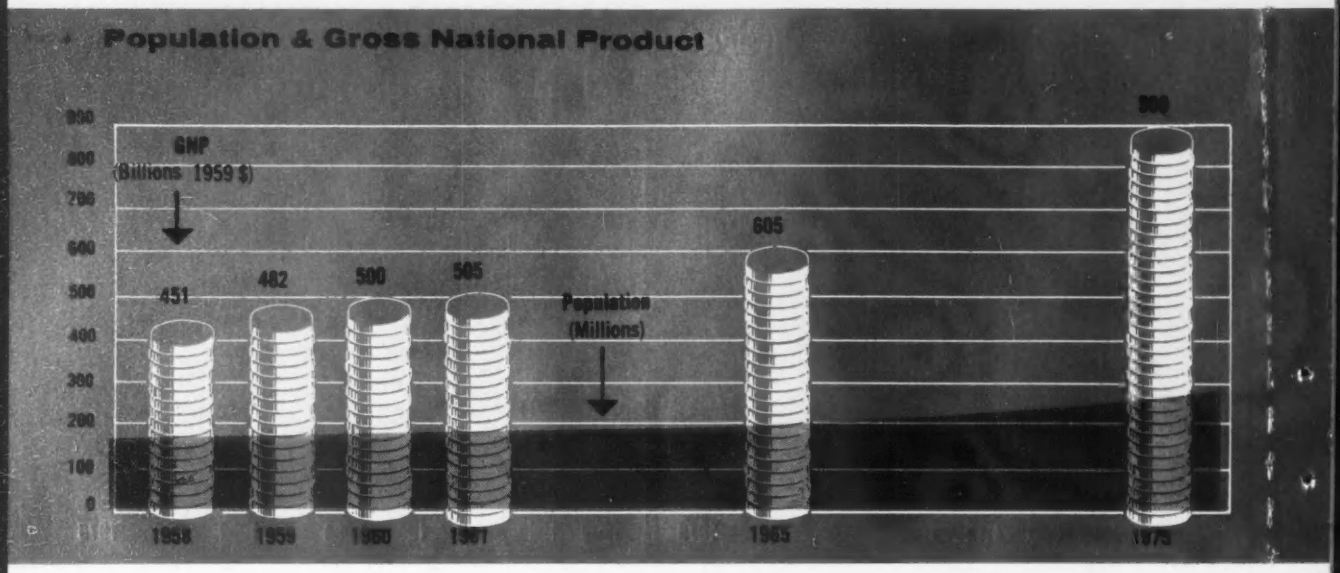
Generation spending will continue to reflect a reduced level of capacity additions dwindling from 1959's $2.37 billion to this year's $2.2 billion and $2.16 billion in 1961. An upward trend should begin with 1962's $2.19 billion.

Transmission plant expenditures, at $790 million in 1960—11.6% over last year—will dip to $747 million in 1961 and bounce back to $781 million in 1962.

Distribution spending should chalk up a 7.1% increase in 1961 on top of this year's 9.0% jump to $1.54 billion.

Construction Expenditures

	Generation	Transmission	Distribution	Miscellaneous	Total
		million dollars			
1955	$1,548	$571	$1,343	$161	$3,623
1956	$1,479	$598	$1,518	$186	$3,781
1957	$2,234	$747	$1,566	$199	$4,746
1958	$2,582	$764	$1,373	$187	$4,906
1959	$2,369	$708	$1,413	$180	$4,670
FORECAST					
1960	$2,200	$790	$1,540	$200	$4,730
1961	$2,164	$747	$1,649	$178	$4,738
1962	$2,189	$781	$1,778	$185	$4,933
1963	$2,324	$833	$1,903	$197	$5,257
1964	$2,689	$926	$2,037	$220	$5,872
1965	$3,160	$1,039	$2,181	$249	$6,629
1970	$4,697	$1,510	$3,094	$363	$9,664
1975	$6,696	$2,153	$4,414	$517	$13,780

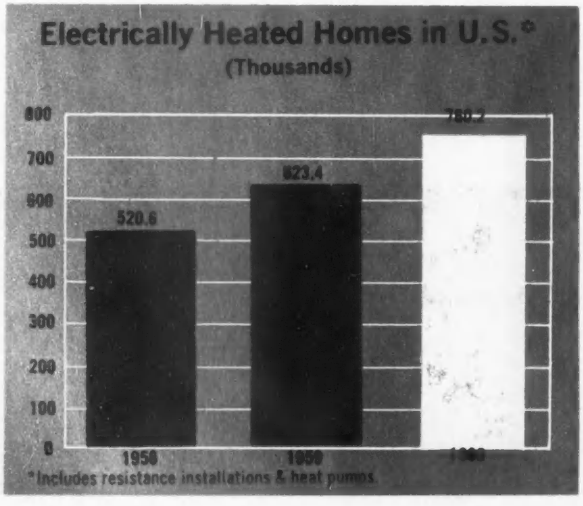


Residential Sales Will Reflect

Despite a recent dip in the birth rate, population growth is still counted on as a major contributor to our future economic growth. Population experts say this dip has little effect on earlier long-range forecasts since the young adults counted on to send population soaring in the late sixties are already well on the way to maturity.

On July 1 of this year our population totalled 180.5 million people, thus racking up a gain of 28.8 million in the past decade alone. In the next fifteen years experts predict a gain of 55 million new citizens putting 1975's total at 235.5 million. While this may sound wildly optimistic consider that it will take an average of only 3.6 million new people a year to achieve this level compared with the past decade's average of almost 2.9 million a year from a smaller total population.

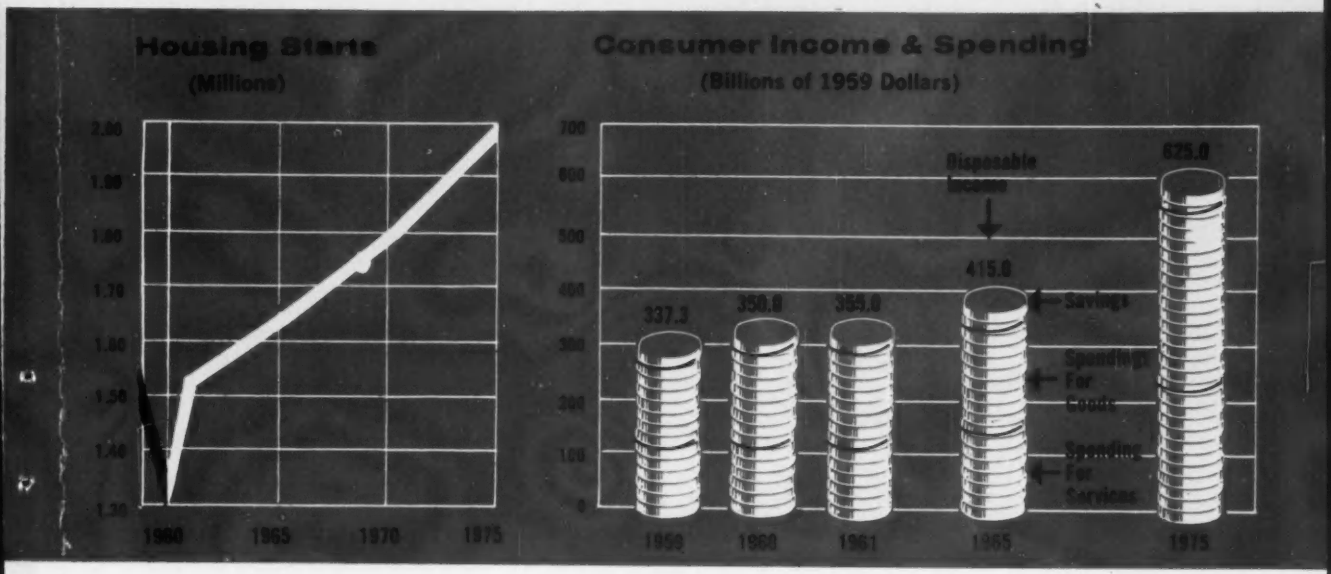
Household formations, will snap out of the doldrums as the post-war children start setting up homes. Last year household additions hit a low of 600 thousand units. This year they bounced back to 800 thousand. By 1975 economists see households hitting about 68.5 million compared with this year's 52 million. But most important they expect 1975



Electrically Heated

The number of all electrically-heated homes is increasing at an average rate of about 21% a year and should hit 760.2 thousand units by the end of 1960. This year alone the increase is estimated at about 22% compared with a gain of 19.7% in 1959. These encouraging estimates are based on a recent Electrical World survey of the nation's electric utilities.

In absolute terms these gains are somewhat more sobering. The 22% gain this year stands for 136.8 thousand new installations and last year's 19.7% represented 102.8 thousand new electric heating customers. However, the encouragement stems from the fact that the number is not only increasing but it is increasing in the face of a downturn in total new home construction.



Population and Household Growth

annual additions to be in the 1.3 million range.

New home construction will have to keep pace with household and population growth. Thus, on the new Bureau of Census series (which starts with 1959) new dwelling unit construction in 1975 should be at an annual rate of at least 2 million units. This compares with 1959's total of 1.55 million units and an estimate of 1.35 million units for 1960. Incidentally, at this point economists are estimating 1.53 million units in 1961 due to an anticipated easing of mortgage money rates.

Zooming population plus a higher standard of living will in turn boost the nation's Gross National Product (a measure of the nation's overall output of goods and services), economists tell us. New products, new industries and new services combined with greater economic efficiency should boost GNP to $900 billion (in 1959 dollars) by 1975—80% over this year's expected record of $500 billion which is 3.7% ahead of 1959.

Almost 70% of 1975's GNP will be consumer disposable income. This means our citizens will have $625 billion in 1975 to spend on goods and services. That's almost 79% more than this year's

Homes Up 22% in '60

Last year's addition of 102.8 thousand represented only 6.6% of all new homes while this year's gain of 136.8 thousand will be almost 10.1% of new additions.

As the table at the right indicates the regions having the greatest saturation of electrically-heated homes are the combined South Atlantic and East South Central regions with 49.5% of the total and the Pacific region with 35.3% of the total. Next in line is the East North Central with 8.2%.

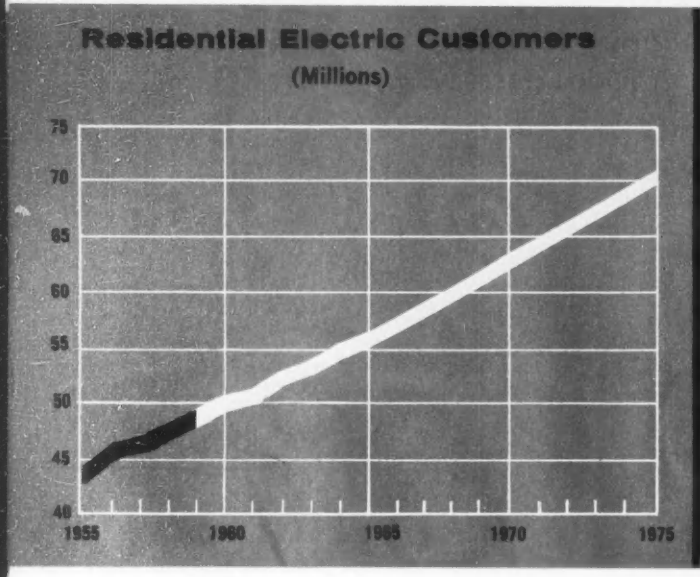
However, it's interesting to note the two year growth rates in the various regions. On relatively small bases West South Central leads in growth with 382% followed by New England with 300%. Next is West North Central with a 264% jump.

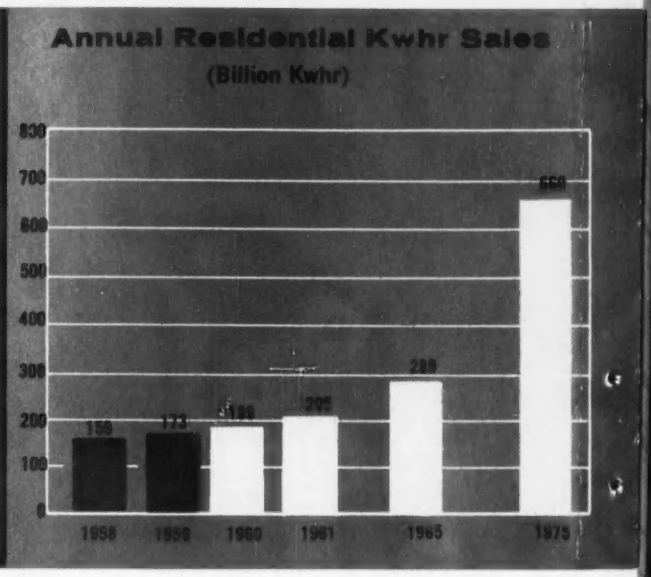
Electrically Heated Homes by Regions

(Estimates Based on Electrical World Survey)

	1958	1959	1960
New England	400	800	1,600
Middle Atlantic	17,000	20,600	25,900
East North Central	29,400	43,000	62,100
West North Central	2,200	4,300	8,000
South Atlantic & East South Central*	269,900	316,100	376,100
West South Central	2,700	6,900	13,000
Mountain	2,700	3,500	5,300
Pacific	196,300	228,200	268,200
Total Contiguous U.S.	**520,600**	**623,400**	**760,200**

* Breakdown not available





New Customers and 161% Jump in Average Use

estimated $350 billion and 85.5% over 1959.

Gains in consumer disposable income should play a big part in boosting residential sales in future years. With people seeking more and more leisure time it's reasonable to assume that consumer expenditures should go increasingly for the comfort and convenience of electric living.

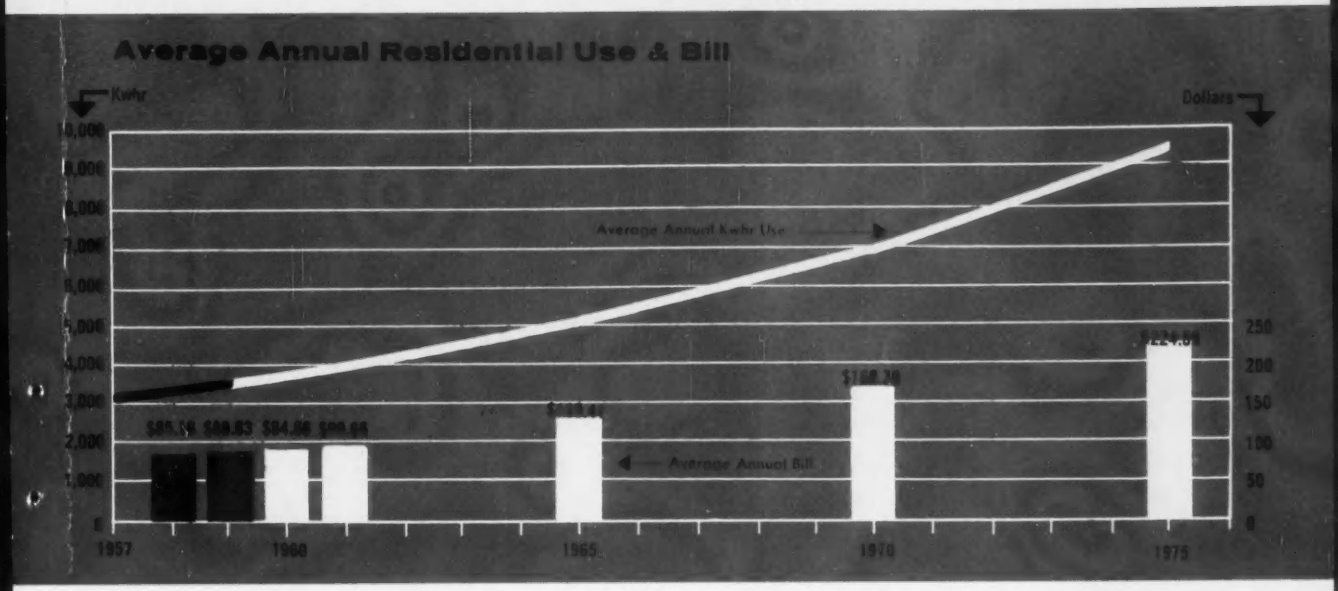
Thus, with increased consumer disposable income providing the opportunity, average residential use of electricity should hit about 9,362 kwhr by 1975. This will be a jump of 161% over last year's 3,585 kwhr per average customer. This year, due to an exceptionally cool summer over most of the nation, average use will increase only 6.5% to 3,817 kwhr.

In addition to greater useage by the average customer, there will naturally be more customers due to expanding household formations. By 1975 resi-

Population, Households, GNP

	Population at Mid-Year	New Dwelling Units	Households at Mid-Year	Gross National Product	Consumer Disposable Income
	millions	thousands	millions	billion 1959 dollars	billion 1959 dollars
1955	165.3	NA*	48.0	441.5	296.0
1956	168.2	NA	49.0	450.9	310.3
1957	171.2	NA	49.7	459.2	317.8
1958	174.1	NA	50.6	451.3	321.1
1959	177.1	1,553	51.2	482.1	337.3
		FORECAST			
1960	180.5	1,350	52.0	500.0	350.0
1961	183.6	1,525	53.0	505.0	355.0
1962	186.7	1,550	54.0	515.0	365.0
1963	189.8	1,575	55.0	555.0	380.0
1964	192.9	1,600	56.0	580.0	395.0
1965	196.0	1,650	57.0	605.0	415.0
1970	214.0	1,800	62.5	740.0	510.0
1975	235.5	2,000	68.5	900.0	625.0

* NA—Not Available. Figures based on new series by Bureau of the Census



to Boost Residential Sales 282% by '75

dential customers will number 71.1 million—an increase of 45% above last year.

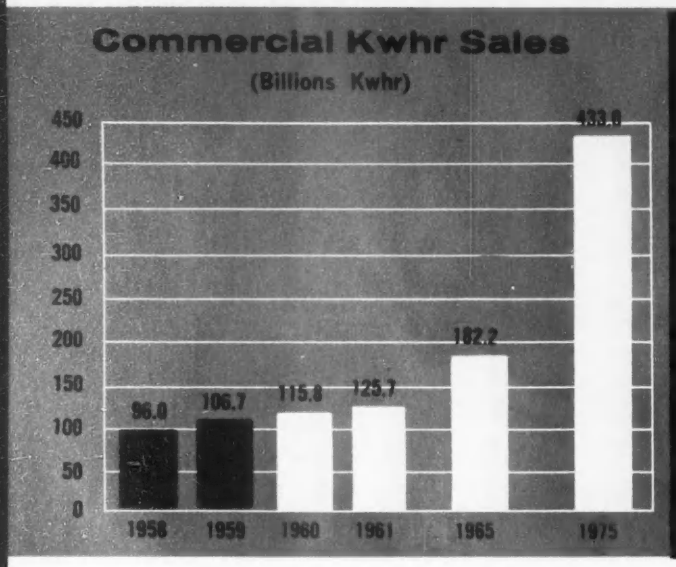
The combination will boost residential electric sales to 660 billion kwhr in 1975—282% above 1959's 173 billion kwhr. In 1960 the annual gain is estimated at about 9.2%.

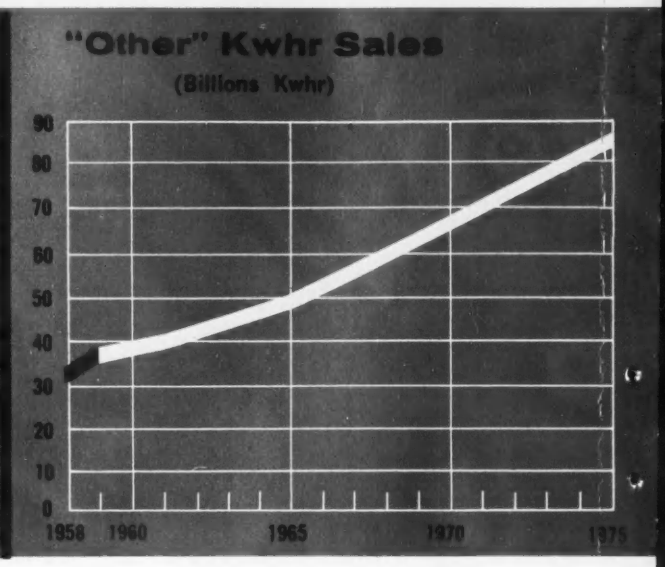
The cost of the residential customers "biggest shopping bargain" will continue to decline although probably not as fast as it has in the past. Increased use by consumers will contribute to most of the decline as the average cost per kwhr falls from last year's 2.50¢ to 1975's 2.40¢.

Thus, despite a 161% increase in average usage by '75, the average residential electric bill will increase only 151% to $224.69. This year the average bill will hit $94.66—5.6% higher than last year resulting in residential electric revenues of $4.7 billion—8.2% over 1959.

Average Residential Use and Residential Sales

	Customers	Use Per Customer	Revenue per Kwhr	Average Annual Bill	Sales	Revenue
	millions	kwhr	cents		billion kwhr	million dollars
1955	44.4	2,751	2.64	$72.63	120.5	$3,187
1956	45.7	2,969	2.60	$77.19	133.9	$3,477
1957	46.9	3,174	2.56	$81.25	147.1	$3,759
1958	47.8	3,366	2.53	$85.16	159.0	$4,025
1959	49.0	3,585	2.50	$89.63	173.4	$4,338
FORECAST						
1960	50.2	3,817	2.48	$94.66	189.3	$4,695
1961	51.4	4,035	2.47	$99.66	205.0	$5,063
1962	52.7	4,280	2.46	$105.29	223.0	$5,486
1963	54.0	4,532	2.45	$111.03	242.0	$5,929
1964	55.3	4,845	2.44	$118.22	265.0	$6,467
1965	56.6	5,161	2.43	$125.41	289.0	$7,023
1970	63.6	7,000	2.41	$168.70	441.0	$10,628
1975	71.1	9,362	2.40	$224.69	660.0	$15,841





Commercial Customers Offer Large Potential

Jet propelled by a burgeoning population and a commercial construction boom, kwhr sales to commercial customers have grown rapidly in the past decade. Between 1955 and 1959 alone, commercial kwhr sales jumped 39.8% to 106.7 billion kwhr sparked by a 5% increase in customers and a 33% jump in average annual use per customer.

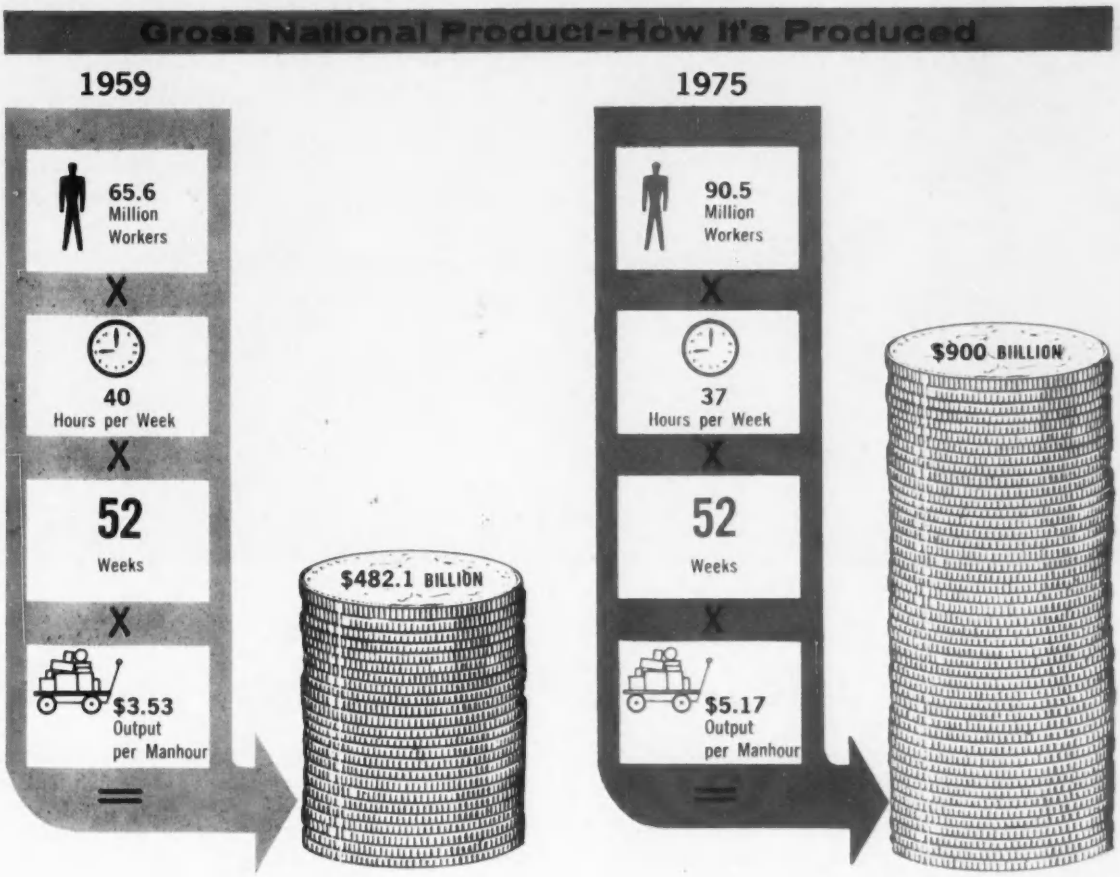
This increase in use per customer reflects a constant shift to new or modernized stores and office buildings with higher lighting levels, air-conditioning and up-to-date office equipment. But this shift has hardly dented the vast number of outdated retail stores and office buildings now in existence.

With such potential, commercial kwhr sales could easily skyrocket 306% by 1975 to 433 billion kwhr with average annual commercial use jumping 181% over last year's 16,896 kwhr to 47,533 kwhr. During 1960 commercial sales should chalk up an 8.5% gain and then repeat in 1961 pushing the total to 125.7 billion kwhr.

Commercial and Other Sales

	Commercial Customers* thousands	Average Annual Use per Customer* kwhr	Commercial Sales* billion kwhr	Rural Sales billion kwhr	Street & Highway Lighting Sales billion kwhr	Other Public Authority Sales billion kwhr	Railway & Railroad Sales billion kwhr	Inter-departmental Sales billion kwhr
1955	6,020	12,722	76.3	10.8	4.4	10.2	4.6	0.6
1956	6,102	13,649	82.9	11.1	4.7	11 0	4.4	0.6
1957	6,163	14,658	90.0	11.3	5.1	11.8	4.1	0.6
1958	6,256	15,414	96.0	11.1	5.5	12.8	3.8	0.6
1959	6,333	16,896	106.7	13.0	5.9	14.2	4.1	0.6
FORECAST								
1960	6,509	17,984	115.8	12.4	6.3	15.6	4.7	0.6
1961	6,663	19,104	125.7	12.5	6.8	16.7	4.7	0.6
1962	6,835	20,373	137.4	12.6	7.4	18.0	4.7	0.6
1963	7,019	21,870	151.4	12.9	8.1	19.4	4.7	0.6
1964	7,210	23,354	166.1	13.2	8.9	20.9	4.7	0.6
1965	7,397	24,939	182.2	13.6	9.8	22.5	4.7	0.6
1970	8,270	34,469	281.9	15.8	14.9	30.9	4.7	0.6
1975	9,200	47,533	433.0	18.3	22.6	40.2	4.7	0.6

*Revised by Edison Electric Institute.



Productivity Must Increase 46% by 1975

The present economic scene with its excess of productive capacity provides a poor background against which to paint a glowing picture of the future. However, based on the factors previously cited plus government's dedication to growth at any cost, it is reasonable to assume that from here on out we will at least hold our own economically.

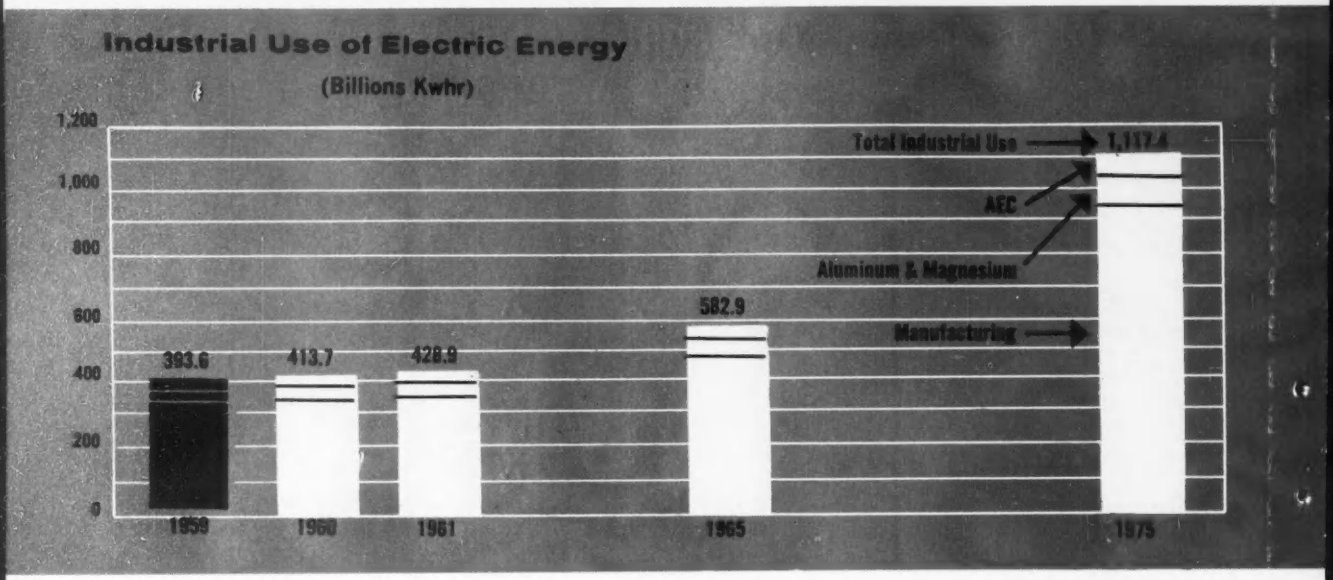
Also, there are dynamic forces at work in the economy that promise growth somewhat above the minimum. First is the present over-capacity situation which spawns fierce price competition and puts a severe strain on profit margins. One result is a never-ending search to reduce costs through more efficient production.

The second dynamic force is the rapidly growing expenditure for research into new products and processes. For instance, this year industry is spending $9.6 billion for research and development and preliminary plans indicate that R&D outlays will increase to $11 billion by 1963. According to the latest McGraw-Hill Survey of Business Plans, new products will account for 12% of the sales of manufacturing companies, on the average, by 1963. If industry continues to step up its R&D effort, there is a good possibility that more than one-third of the sales of manufacturing companies in 1970 will be in new products—products not currently produced.

It is estimated that the resultant higher standard of living will call for an 87% increase in GNP and a 102% jump in industrial production by 1975. But these targets cannot be achieved at today's level of productivity simply because manhours available will not grow in proportion to our increased requirements, despite population growth. This apparent dilemma stems from the fact that the percentage of the population making up the labor force will be shrinking, more labor will be required in less efficient service functions, and the average work week will be shorter.

The net result of these changes can best be seen in the way GNP is produced. Last year 65.6 million workers put in 40 hours per week for 52 weeks to produce a GNP of $482.1 billion. This meant each employee was required to produce $3.53 of goods and services each hour he worked.

By 1975, 90.5 million workers will be called upon to produce $900 billion in GNP by working only



Utility Industrial Kwhr Sales Head for

37 hours per week for 52 weeks. This will require an output of $5.17 each working hour or an increase of 46% over last year.

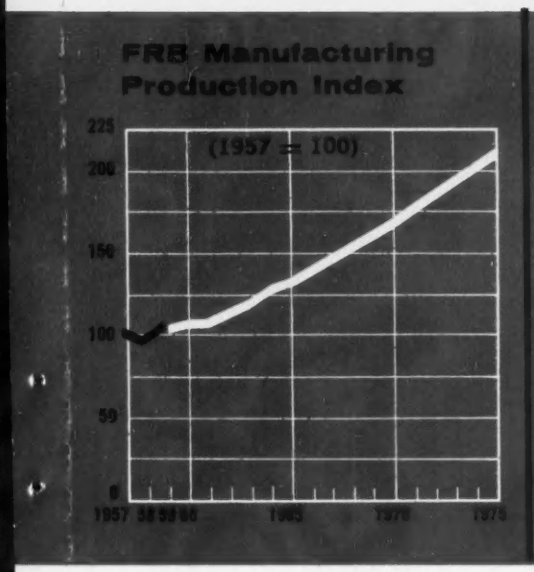
As in the past, efficient, easily applied, electric energy will be called on to fill the "muscle gap" left in the labor force. For instance, back in 1954 manufacturers used 2,629 million kwhr of electric energy to produce each point of the FRB's manufacturing production index. This year they will use 2,920 million kwhr for a gain of 11.1%. Productivity gains by 1975 will boost this to 4,635 million kwhr—a jump of 58.7%.

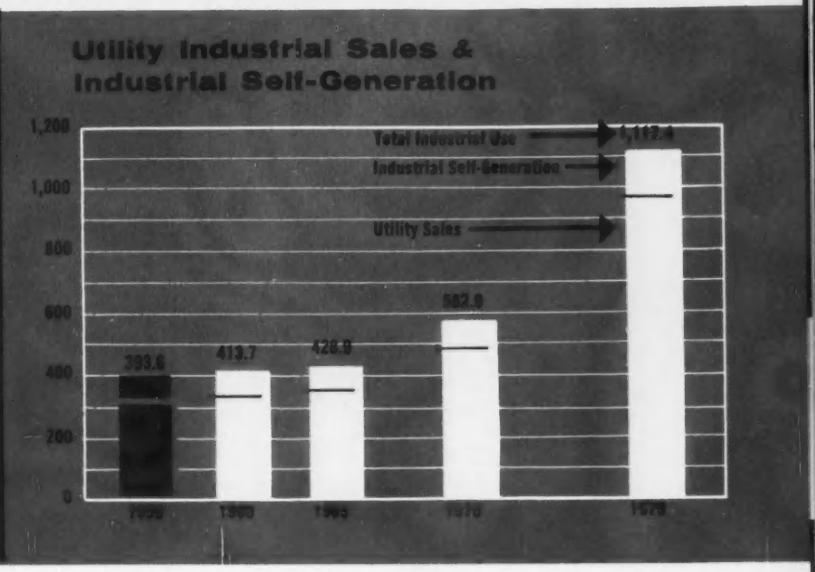
At an FRB of 212, total manufacturing use of electricity in 1975 will add to about 983 billion kwhr—a 224% jump over last year's 303 billion kwhr.

Added to manufacturing use will be large chunks of power taken by the aluminum and magnesium

Indices of Industrial Activity

	Industrial Production 1957 = 100	Manufacturing Production 1957 = 100	Manufacturing Production Workers millions	Primary Aluminum Production thousand tons	Primary Magnesium Production thousand tons
1955	96	97	13.1	1,566	61
1956	99	100	13.2	1,679	68
1957	100	100	12.9	1,649	81
1958	93	92	11.7	1,566	30
1959	105	105	12.2	1,953	31
FORECAST					
1960	110	110	12.5	2,063	37
1961	110	110	12.5	2,112	45
1962	115	116	12.6	2,281	55
1963	123	123	13.0	2,475	65
1964	130	130	13.4	2,698	75
1965	137	137	13.8	2,941	85
1970	170	170	14.8	3,650	135
1975	212	212	15.8	4,250	185





Gains of 5.6% in '60, 4.2% in '61

industries and the Atomic Energy Commission. At estimated 1975 production levels of 4.25 million tons of aluminum and 185 thousand tons of magnesium, electric energy usage will hit 80.2 billion kwhr—124% higher than last year. The AEC load should hold at a fairly constant 54.6 billion kwhr per year.

Added together these groups offer a total industrial electricity market of 1.1 trillion kwhr in 1975. That's a jump of 184% over last year's 394 billion kwhr.

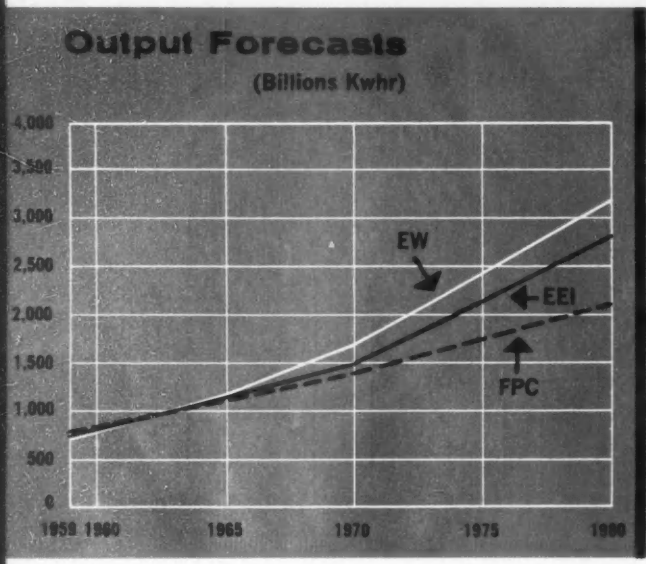
About 15% of this annual load will be supplied by industrial plants themselves. By 1975 industrial self-generation will increase 95% to around 165 billion kwhr.

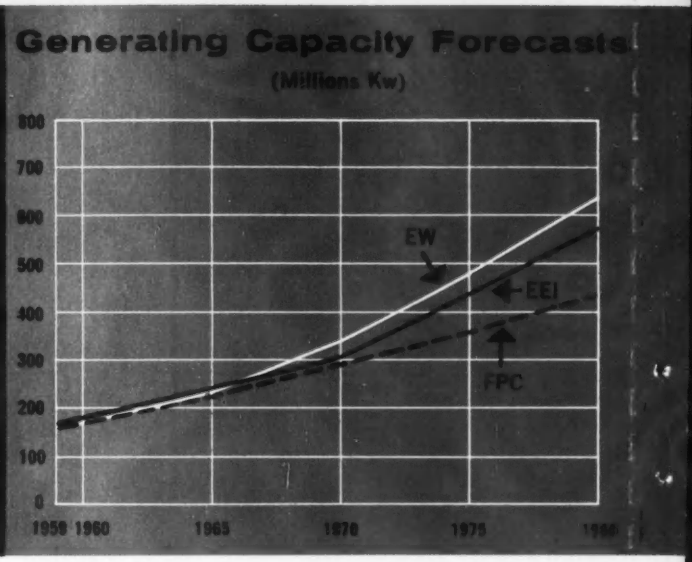
The net result will be a 208% jump in utility sales to industrial customers putting 1975 sales at 952 billion kwhr.

Industrial Use of Electric Energy

	Manufacturing Use	Aluminum and Magnesium	AEC Use	Total Industrial Use	Generation by Industrial Plants	Utility Industrial Sales*
	billion kwhr					
1955	259.7	29.4	46.6	335.7	82.0	253.7
1956	276.2	31.6	57.8	365.6	84.1	281.5
1957	284.7	31.3	56.6	372.6	84.8	287.8
1958	276.5	28.8	54.6	359.9	79.7	280.2
1959	303.1	35.8	54.7	393.6	84.8	308.8
FORECAST						
1960	321.2	37.9	54.6	413.7	87.5	326.2
1961	335.4	38.9	54.6	428.9	88.9	340.0
1962	365.1	42.2	54.6	461.9	91.7	370.2
1963	399.4	45.9	54.6	499.9	94.6	405.3
1964	435.6	50.1	54.6	540.3	97.6	442.7
1965	473.7	54.6	54.6	582.9	100.7	482.2
1970	680.0	68.4	54.6	803.0	119.0	684.0
1975	982.6	80.2	54.6	1,117.4	165.0	952.4

* Revised by Edison Electric Institute.





1980 EW Forecast Tops EEI and FPC Targets

About the only area of agreement among these industry forecasts is the fact that they all show growth. In terms of energy output, over last year, the Federal Power Commission predicts an increase of 191% by 1980, Edison Electric Institute forecasts a boost of 295% and Electrical World forecasts a jump of 350% by 1980. However, all three forecasts do agree that growth percentagewise will be a bit slower in the decade of the seventies.

Using FPC's 1980 output of 2.1 trillion kwhr as a base we find EEI's 2.8 trillion kwhr 33% higher and EW's 3.2 trillion kwhr 52% higher.

Peak load forecasts follow almost the same pattern although here there is some agreement between the EEI and EW forecasts. FPC anticipates a gain of 195% in peak loads by 1980 while EEI's gain is 288% and EW's is 323%. Again, with FPC's 1980 peak load of 380 million kw as a base, EEI is 32% higher and EW is 36% greater.

Predictions for generating capacity requirements in 1980 range from FPC's low of 437 million kw (a 178% increase) to EW's 630 million kw (a 299% jump). In the middle is EEI's 576 million kw (a 249% gain).

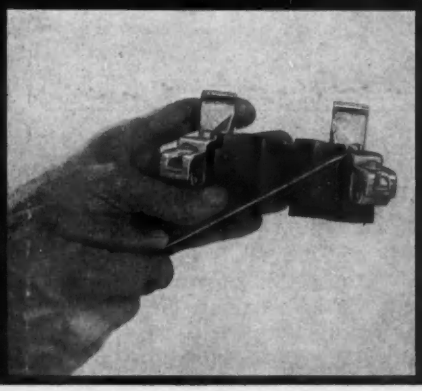
Comparison of Electrical World, Federal Power Commission and Edison Electric Institute Forecasts

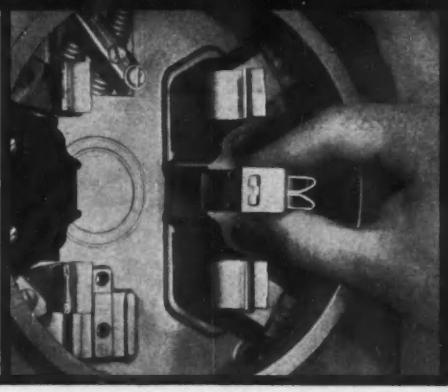
	Output[1] (Billions Kwhr)			Peak Loads[1] (Millions Kw)			Generating Capacity[1] (Millions Kw)		
	FPC	EEI	EW	FPC	EEI	EW	FPC	EEI[2]	EW
1959	716	707	707	129	129	122	157	165	158
1965	1,075		1,138	197		190	226		232
1970	1,379	1,481	1,672.5	252	265	276	290	305	337
1975	1,716		2,422.8	313		392	360		479
1980	2,084	2,795	3,184.4	380	501	516	437	576	630

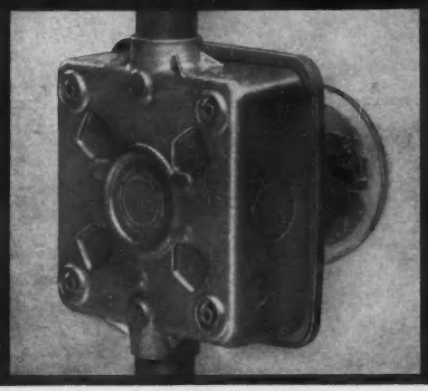
FPC—August 1960, EEI—January 1960, EW—September 1960

Notes: [1] FPC output, peak loads and capacity are total industry. EEI and Electrical World data is for Class 1 systems representing more than 97% of the industry. Capacity figures represent capability.

[2] "Based on an assumed margin of 15% which is not purported to be a required reserve but is considered to be adequate, on the average."







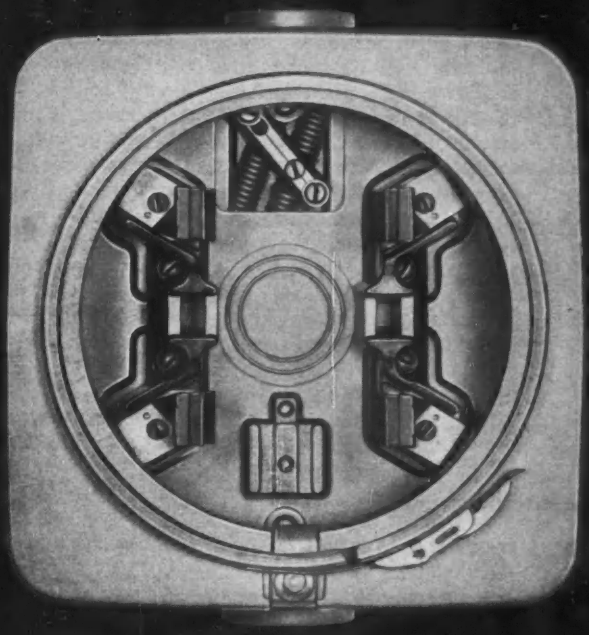
NEW S-2 TERMINAL BLOCK ASSEMBLY—with exclusive one-piece combination jaw and connector strap—permits an unbroken current path from meter blades to line wires for excellent electrical conductivity, low heat rise, for added reliability.

NEW PLUG-IN TERMINAL, another General Electric S-2 exclusive, installs in seconds—without tools, and without removing any part of the meter socket . . . greatly simplifying shop or field conversion to five or six terminal sockets.

EXCLUSIVE SQUARE DIE-CAST ALUMINUM CASE—with baked-on all-weather finish — gives maximum strength, corrosion protection . . . provides full raintight construction . . . unitized hubs. And, modern styling eliminates sharp, hazardous corners.

General Electric Announces . . .

NEW S-2 SQUARE METER SOCKET



General Electric S-2 sockets—for all 100-amp services—offer two **exclusive** new features providing greater reliability, increased versatility.

GREATER RELIABILITY is provided by unique one-piece combination jaw and connector strap—permitting an unbroken current path from meter blade to line or load wires with minimum heat rise.

INCREASED VERSATILITY results from the only true plug-in terminal on the market today . . . installs in seconds—without tools—for easy conversion to five or six terminal socket.

PLUS 6 EXTRA VALUE FEATURES

1. **Largest wiring space** of any die-cast socket—144 cubic inches—permits fast, easy wiring.
2. **Die-cast aluminum case**—plus baked-on finish—protects against corrosion and weather.
3. **Lay-in wire connectors** accommodate both aluminum and copper wire.
4. **Positive one-way knockouts** provide a perfect knockout every time . . . eliminate prying or bending.
5. **Choice of neutral connectors**—two channel or single lay-in neutral connector.
6. **Unitized hubs** are cast as part of case . . . no extra charge for second hub at bottom.

NOW AVAILABLE. *Contact your G-E Sales Office or Authorized Distributor for full S-2 information. Or, write General Electric Company, Somersworth, N. H.* 711-01

METER DEPARTMENT

GENERAL ELECTRIC

Determine Distribution Voltage Drop

K. H. WOODS, Senior Electrical Engineer, System Distribution Design Dept, Southwestern Public Service Co, Amarillo, Texas.

Voltage drop charts, evolved through exact scaled values of calculations involving line angle, line resistance, inductive reactance and load power factor, can provide quick practical solutions to many 3-phase distribution problems. Loading is shown in kw-miles because (1) the load x distance quantity is the factor that produces voltage drop, and (2) for a given load over a given line the kw will remain basically constant while the kva may vary considerably according to the power factor of the load. The amount of kva, with its power factor, governs the amount of voltage drop over a given line.

The charts are based on nominal system voltage and the percentage voltage drop is referred to the receiving end, as are the load and power factor. By using the receiving end basis for calculations, it was thought that the chart usage and the assumptions that must be made would most easily produce usable results under varying conditions.

Items that may be determined include:

1. Percent voltage drop of a given kw load at a given pf over a given number of miles of line.

2. Percent voltage drop of a given kva load at a given pf over a given number of miles of line.

3. Final percent voltage drop resulting from changing the pf of a given kw or kva load over a given number of line miles.

4. Percent voltage change produced by adding kvar to or removing kvar from a given load or line.

5. Amount of kvar (capacitors) needed for a desired percent reduction of voltage drop.

Sample chart applications:

With a 200-kva load at 70% lagging pf, find the percent voltage drop over 5 miles of 1/0 ACSR, 3-phase, 4,160-v line.

Solution:

a. 200 × 5 = 1,000 kva-miles

b. Locate 1,000 kw-mile load line and the point of its intersection with the Unity Power Factor Line (A).

c. From (A), with *0* as center, construct an arc to the 70% lagging pf line (B) and note that this point falls on the 700 kw-mile load line.

d. At (B) read 8% voltage drop.

If a 90-kvar capacitor bank is installed near the above 200-kva 70% pf load, find the resulting percent voltage drop, approximate average pf of the load over the line, and the average kva over the line.

a. 90 × 5 = 450 kvar-miles

b. Scale off 450 along the Unity Power Factor Line and from (B) project this length up and to the left along the kw-mile load line on which (B) fell. In this case it is the 700 kw-mile load line.

c. At the point where this projection terminates, (C), read 5.8% voltage drop. In this case, therefore, the 90-kvar capacitor bank has corrected for 2.2% voltage drop.

d. It will be noted that the indicated pf is lagging 93.5%.

e. With *0* as center, construct an arc from (C) to (D).

f. At (D) read 750 along the Unity Power Factor Line.

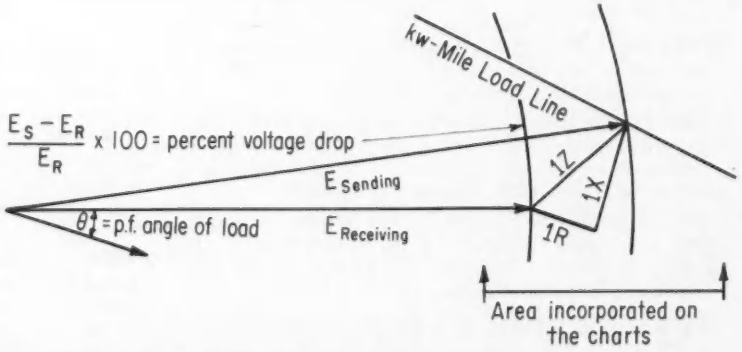
g. This represents 750 kva-miles, so the load kva = 750 ÷ 5 miles = 150 kva. This is the actual resulting load with 93.5% lagging pf.

Variations of these problems may also be solved on the charts. Their flexibility permits the reversal of the sequence of operations when necessary. In applying the charts to longer lines composed of various sized conductors, the lines may be separated into segments. This may introduce a slight error, but for practical applications it is negligible.

Line resistances are taken at 122F (50C), as Southwestern Public Service Company's critical time for voltage drop usually occurs during the hotter months. Line reactances are taken for equivalent spacings of 53.2 in. on 8-ft crossarms, normally used in 2,400 and 4,160-v construction, and 66.4 in. on 10-ft crossarms, normally used in higher distribution voltage construction.

Even though the charts are based on 4,160 v, multipliers are shown to make the charts applicable to 2,400-v, 12,470 and 13,200-v systems. Because the 2,400-v construction is the same as that for 4,160 v, their line impedances are identical for like conductors. Therefore, the multiplier shown for 2,400 v will give exact results in all cases.

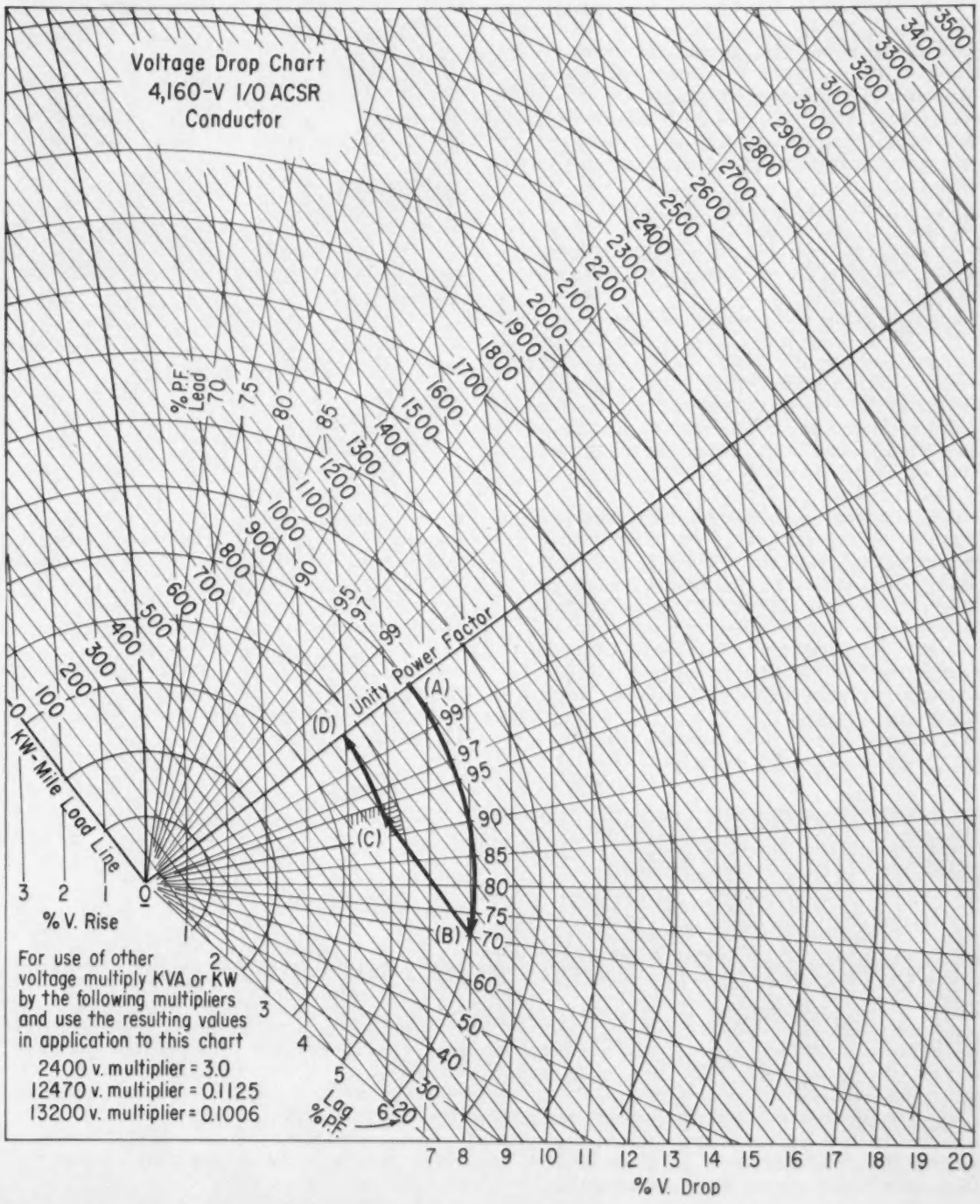
Because of different conductor spacings on 12,470 and 13,200-v systems, the multipliers for these voltages will give exact results when the power factor considered is along a line parallel to the base of the



DERIVATION OF THE VOLTAGE DROP CHART was made from the basic voltage vector diagram

chart, with slight errors in voltage drop being introduced when considering power factors along lines in a counter-clockwise location from this horizontal position. For practical applications, however, this is negligible. For this reason it was not considered necessary to produce different voltage drop charts for the different class voltage systems.

Charts of this type have been produced for many of the conductors in more common usage in distribution construction for both ACSR and copper.



Low-Cost Pole Patch Plugs Bird's Door

C. H. MURRAY JR, Line Inspector, Appalachian Power Co, Point Pleasant, W. Va.

Cavities in wood poles can be filled simply and effectively with a compound developed primarily for tree surgery. Repairing such damage to poles as woodpecker holes with "Flexifil," developed by Bartlett Tree Experts, can forestall a costly pole replacement. Experience at Appalachian Power Co shows that:

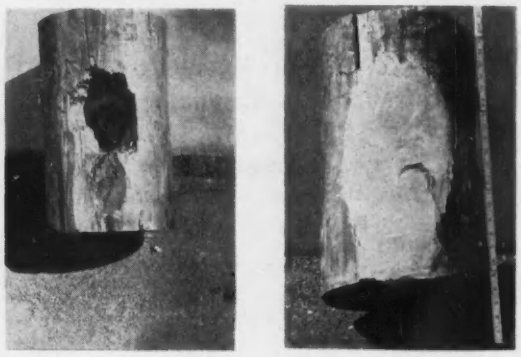
- The hole can be sealed effectively to prevent further damage inside the pole.
- The compound will keep the bird from enlarging the hole and may even discourage him from returning to the pole.
- A portion of the pole's strength will be restored.

The filling compound comes as two separate powders, consisting of a patent cement, asbestos and a refined calcium chloride flake. Cost is less than 40¢ per lb. The powders are mixed with water as needed to form a paste. The resulting hard patch clings to the wood fibers without shrinking. The cavity should be cleared of rot and treated before the patch is installed.

The permanent patch has essentially the same coefficient of expansion as wood. Tests over a temperature range from 0 to 80F (in the presence of moisture) showed no signs of separation between the filling and the wood fibers. The material sets firm in 24 hr at 75F and 50% relative humidity. It sets up harder than wood but it can be cut or sawed like wood. Strength of the material increases with age; reinforcements, such as nail spikes or wire mesh, can be used if necessary.

Considerable testing of the strength of the compound in use provided results which satisfied concern over whether the compound would crumble and fall out when subjected to mild compressive forces. For example, sample cylinders of the material cured for only 24 hr withstood an average of 200 psi compressive load.

Tests of tensile strength, while limited by the testing equipment available, indicated improvement in a pole's strength and offered further assurance over use of the material. However, the material should not be used in any application unless the strength of the remaining part of the pole is adequate for present loads.



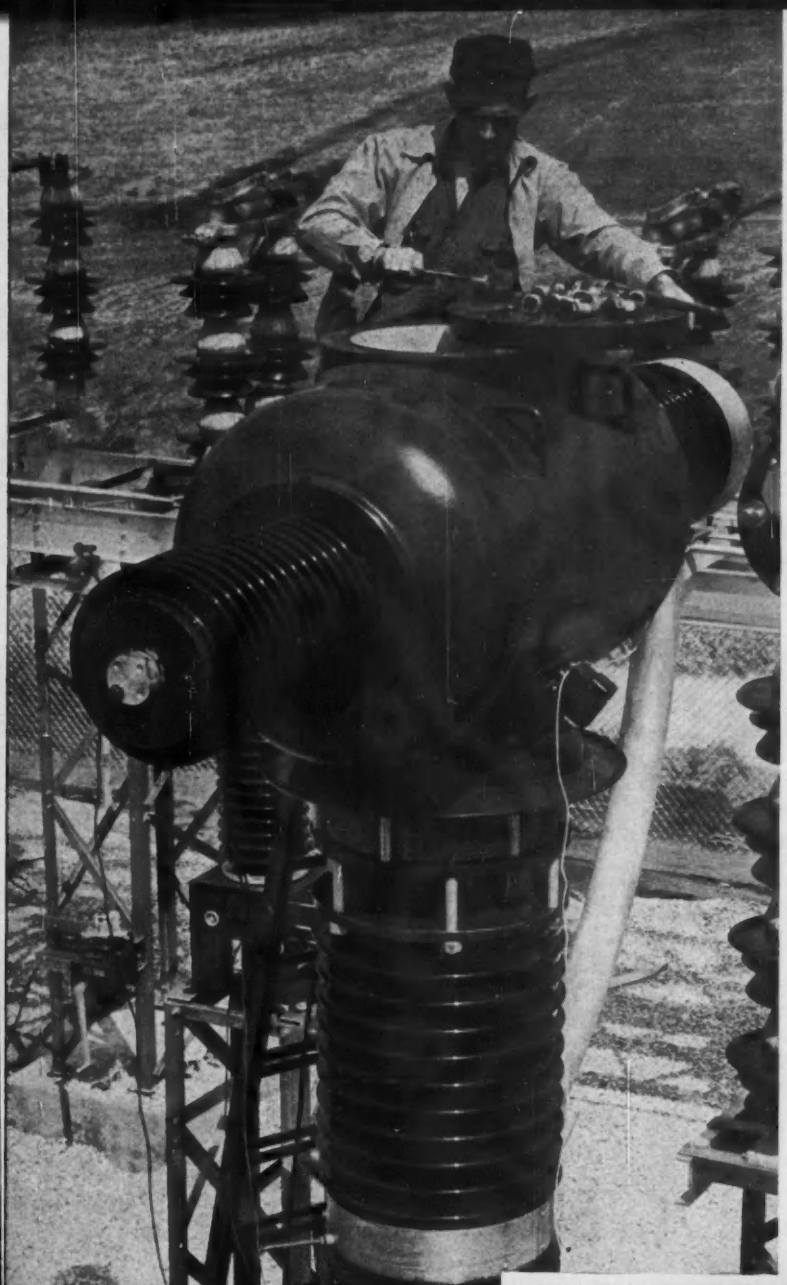
AN EFFECTIVE PATCH in a sample from a 4-month-old 65-ft pole from a 69-kv line shows how a repair job costing about $20 would have saved a pole replacement costing hundreds of dollars

Microfilm on IBM Cards Tried for Quick Retrieval

Microfilming of engineering records could gain considerable savings in records storage space for TVA. Furthermore, when the microfilm is tied in with an IBM card system, high speed machine retrieval of specific drawings can be achieved.

The microfilming project, begun recently on a trial basis, will if the process proves successful, include five million engineering drawings and manufacturers' prints. In the microfilming process, all drawings will be photographed on filmstrips about an inch wide. One set of microfilm images will be mounted on IBM cards. The cards, prepared for mechanical handling, will allow drawings to be found quickly.

Microfilm of drawings which are vital to TVA operations or to national defense will be stored in a special location outside of probable attack areas.



GENERAL ELECTRIC'S
AIR-BLAST DESIGN PROVIDES . . .

Drastically Reduced Maintenance For Power Circuit Breakers

General Electric air-blast power circuit breakers require maintenance only one-third as often as conventional breakers. And when they do, maintenance crews can complete their work in less than one-fourth the time.

Maintenance requirements are reduced because the fast interrupting action of G-E air-blast breakers greatly reduces erosion of contacts, probes, and orifices. Fast interruption occurs because high-pressure is stored in the interrupter head, and is available the instant contacts part.

Normal inspection is simple and fast. It involves exhausting stored air from the breaker, swinging the interrupter access cover aside, and visually inspecting the contacts. If required, the complete operating mechanism can be replaced quickly with a spare unit.

In addition, G-E air-blast breakers can be installed in a fraction of the time normally required to install comparable oil breakers, and provide practical protection for transmission systems 115 to 460 kv and higher.

Why settle for less? Contact your G-E Sales Engineer for more information. Or write to Section 494-06, General Electric Company, Schenectady 5, N. Y.

Progress Is Our Most Important Product

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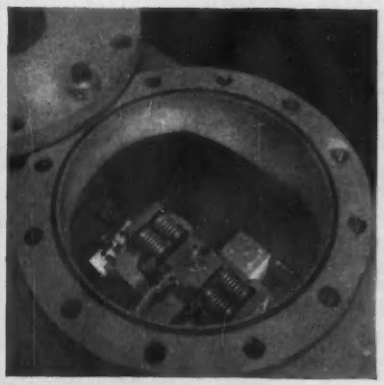


CONTACTS ARE VISIBLE for inspection without removing any parts. If required, the entire operating mechanism can be removed and quickly replaced with a spare unit.

Multi-Panel Map Board Eases Planner's Job

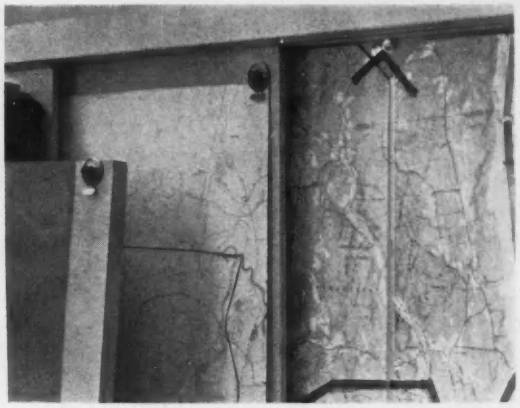
L. M. WEBB, Senior Engineer, Research and Planning Department, Hartford Electric Light Co, Wethersfield, Conn.

A versatile map board eliminates bulging and sagging maps, day-to-day removal and replacement of the various basic area maps, jammed sliding panels, dropped thumbtacks, and many other "thought interrupters" for planners at Hartford Electric Light Co.

Bulging and sagging maps normally encountered with thumbtack-mounted maps, particularly during humid weather, no longer dismay the planner as he "locates a line" or "picks off a mileage." Map-stapled rubber bands, which are in turn thumb-tacked to the board, provide excellent humidity compensation for the map paper.

The tiresome and efficiency-limiting routine of "taking down" the eastern sector map and "putting up" the western sector is avoided by providing ample board space to hang all basic area maps at the same time. The map board runs nearly the entire length of the planning room, and in addition has a panel mounted in a track to allow an additional map to be brought into the planning as required. Standard show-case ball tracks eliminate the broken finger nails and "lost thought-continuities" normally associated with trying to move a jammed panel.

Resorting to a sketch to clarify a point at issue, a planner need not fumble around for pencil and paper, nor drag a clumsy chalk-board stand across the room—a second, separately tracked panel, supports an adjustable height chalk-board which can easily be rolled into the planning fest.



Day-to-day thumb-tacking of the numerous special maps of varying sizes used on the map board and the chalk-board, would soon reduce these boards to a hole(y) mess. Modified bottle-stopper type map holders obviates this problem, as well as doing away with fallen thumbtacks.

The holders are spaced unevenly to provide spans for six different map widths. To assemble such a map holder, the rubber part of the bottle stopper is cut away by an amount equal to the thickness of the board. The stopper's threaded stud is then passed from the back of the board, through a hole drilled at the point of mounting. The outer washer of the stopper is assembled upside down to expose a rounded lip to the map surface. Proper tension against the map is achieved by adjusting the threaded stud's position in the toggle pivot housing.

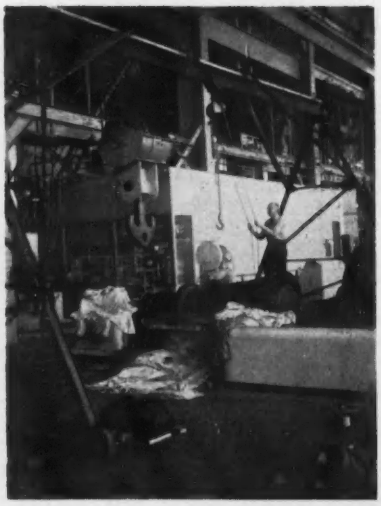
Portable Crane Speeds Turbine Overhaul

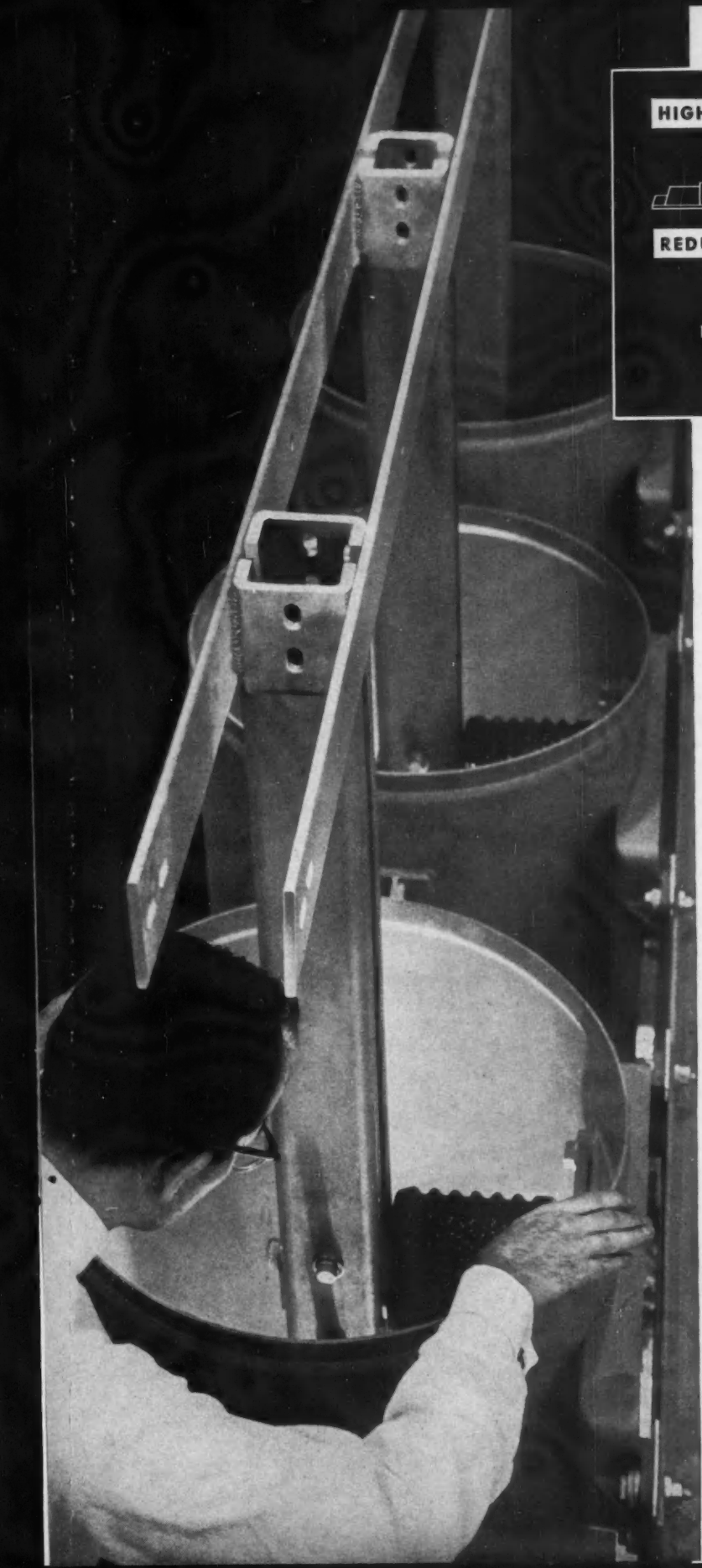
J. D. GRAHAM, Chief Engineer, Mustang Station, Oklahoma Gas & Electric Co, Oklahoma City, Oklahoma

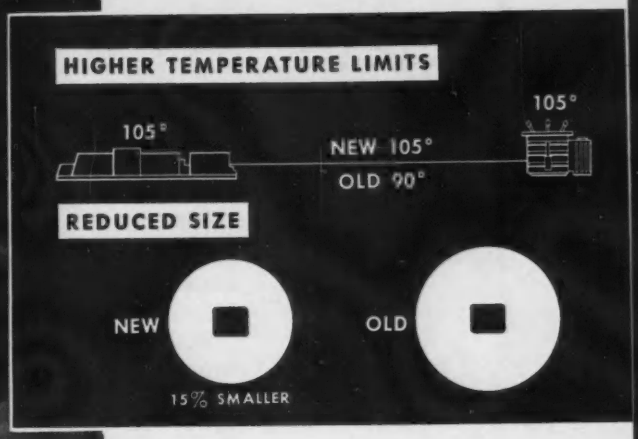
A two-ton capacity portable gantry crane, with its ready availability where and when a specific lift-job occurs, is speeding turbine and generator overhauls at Oklahoma Gas & Electric Co Mustang Station.

While an overhead 150-ton capacity main hoist, and a 10-ton capacity auxiliary hoist are available, these cranes are often tied up for considerable periods of time on major lift-jobs. The two-ton portable crane has enough capacity to expedite the large number of minor lift-jobs required in overhauls.

The portable gantry now being used to such advantage, was originally used elsewhere on the Station. The legs were lengthened by about five feet to allow it to straddle the units. The original steel railroad wheels were replaced with plastic wheels. The two-ton chain hoist is attached to a trolley which can be moved laterally. Furthermore, the crane can be rolled across the entire working area of turbine and generator.







WITH GENERAL ELECTRIC ISOLATED PHASE BUS YOU GET . . .

Higher Temperature Limits— at Reduced Cost

New and tested metallurgical improvements combined with advanced welding techniques now permit the introduction of a 105°C isolated phase bus specifically designed to match turbine-generator and transformer hot-spot operating temperatures.

Upping permissible temperature limits by 15°C reduces bus diameter as much as 15 percent—with a corresponding decrease in cost.

Improved General Electric 105°C bus retains all the original advantages that have always made metal-enclosed duct a superior method of providing conductor support for bus runs. Single-insulator design, reduced maintenance, ability to withstand higher forces, and elimination of condensate problems are basic product benefits.

This new design improvement, a result of intensive fault and heat run testing, is still another contribution from General Electric to help electric utilities reduce their investment per kilowatt hour of operation. For more information, contact your nearest G-E Apparatus Sales Office, or write to Section 496-9, General Electric Company, Schenectady 5, N. Y., for Bulletin GEA-6874.

Progress Is Our Most Important Product

GENERAL ELECTRIC

OUTLOOK ▶ **Purchasing executives intend to hold forward commitments to a minimum** until they can see a longer-term upswing in general business conditions, reported the National Assn of Purchasing Agents in its August business survey. During August, inventory levels were actually lowered by 41% of the PA's reporting in the survey. Only 13% told of increases. The survey covers all types of industry.

Holddown on inventories is further confirmed by the Department of Commerce, which reported that business inventories of manufacturers and distributors were reduced by $100 million during July. This was the first month-to-month decline recorded since the rebuilding of inventories began in December of last year.

Downward price slide for commodities has apparently stopped, said the NAPA survey. However, a large majority of PA's reporting in the survey said that the price situation is unchanged from earlier months, with keen competition prevailing and a continuation of the opportunity to negotiate good deals. Among the items showing some price increases were electrical insulators, aluminum, and gasoline. Listed on the down side were some items of electrical equipment.

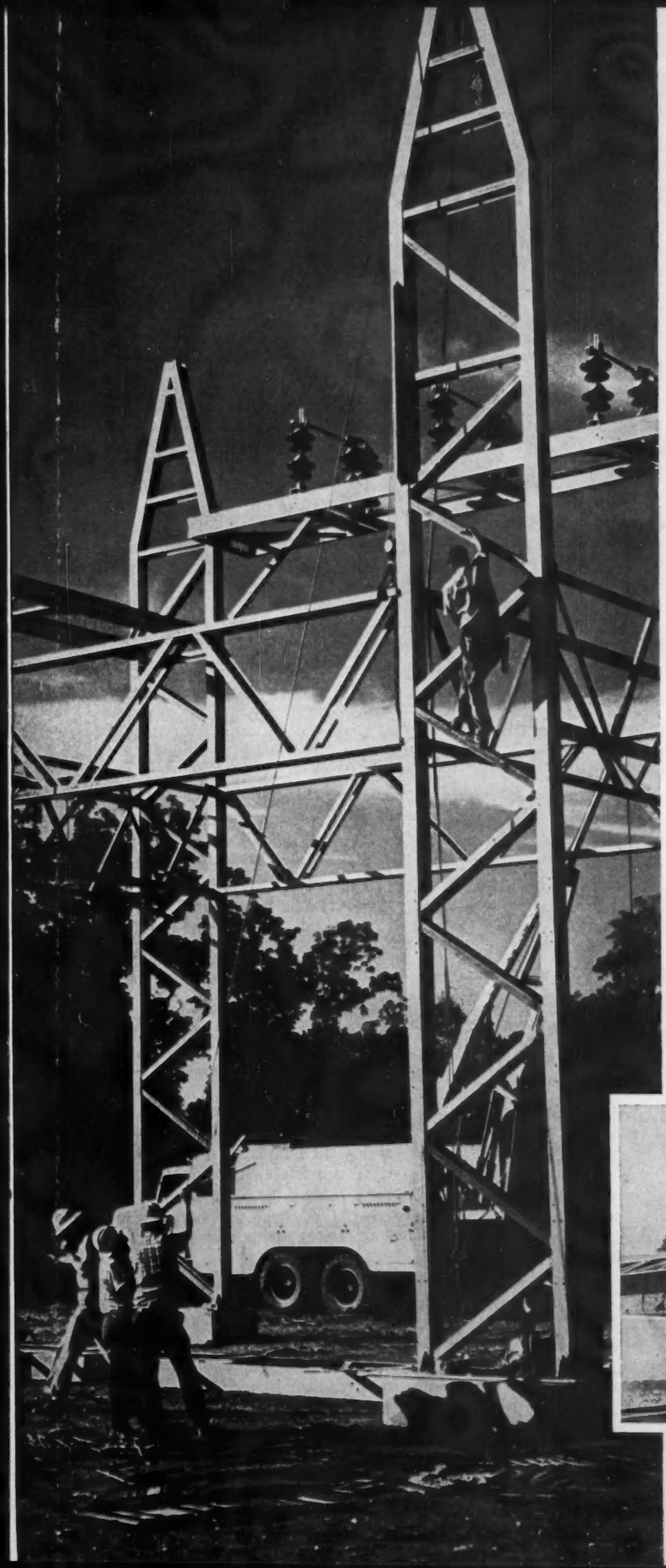
PRICES ▶ **Price reductions averaging 5% on TBI and other ASA bushings** have been announced by General Electric Co. This was part of a realignment in apparatus bushing prices which went into effect Sept. 14. At the same time, prices of most non-standard bushings were increased by an average of 20% over the entire range. N. E. Dillow, Mgr of Marketing for GE's Power Transformer Dept said, "This price realignment is a direct result of the acceptance by the utility industry of GE's TBI (Transformer Breaker Interchangeable) bushing program which has concentrated the bulk of our bushing business in relatively few standard designs. The greater volume has enabled us to reduce our manufacturing costs."

Reduction of 5% in the price of aluminum rigid conduit up to 6 in. dia was announced in early September by Kaiser Aluminum and Chemical Corp and Harvey Aluminum. The reduction was effective as of Aug. 25. Both companies said the price cut was made in an effort to remain competitive in the conduit market. Kaiser said its delivered price in the New York area was identical with that of steel conduit.

BIDDING ▶ **Outcome of one big effort to discourage identical bids** will be known Sept. 20 when Tennessee Valley Authority opens bids on a lot of 28,500 10-in. suspension insulators. In part this is a re-invitation issued after the TVA board had rejected quotations on a lot of 18,000 such insulators. On the first round six domestic manufacturers entered identical bids of $3.25 per unit and one domestic manufacturer entered a bid of $3.20. A Japanese firm bid $2.55 a unit. The agency tossed out all bids and asked US manufacturers to become more competitive.

ANTITRUST ▶ **The federal government will seek damages** against some electrical manufacturers that are under indictment for antitrust violations. This word came from Acting Asst Attorney General Robert A. Bicks who spoke recently before the association of state purchasing officials in Kennebunkport, Me. Bicks noted that state governments have a similar right to sue for damages where it can be shown they have suffered losses because of an antitrust violation, such as a rigged bid.

Identical bidding is a "nagging problem" for government agencies at all levels, Bicks said. He told the state PA's that since 1936 federal purchasing agents have been required to report to the Justice Department on all identical bids. The acting asst attorney general suggested that state governments might want to adopt a similar procedure and said experts in his division would be available for consultation and assistance.



CO-ORDINATED DESIGN, MANUFACTURE AND SHIPMENT MEAN YOU CAN . . .

Cut Installation Time and Costs With General Electric Outdoor Stations

You can reduce installation time, cost and worry when you buy a complete outdoor station from General Electric. Here's why:

- **There are no "bottleneck"** parts to wait for, and no "forgotten" items. Components are either in stock, or can be manufactured repetitively to meet your exact specifications.
- **Components are shipped** to coincide with your construction schedule. "Piecemeal" shipments are avoided.
- **All electrical and structural items** are co-ordinated mechanically and electrically because you are purchasing from one manufacturer.

To meet your individual requirements, you have a choice of lattice-work structures or rolled-shape columns of aluminum or galvanized steel.

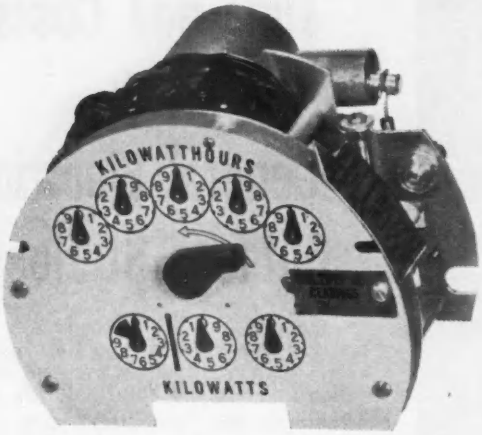
Why settle for less? For more information, contact your G-E Sales Engineer. Or write to Section 495-12, General Electric Co., Schenectady 5, N. Y.

Progress Is Our Most Important Product

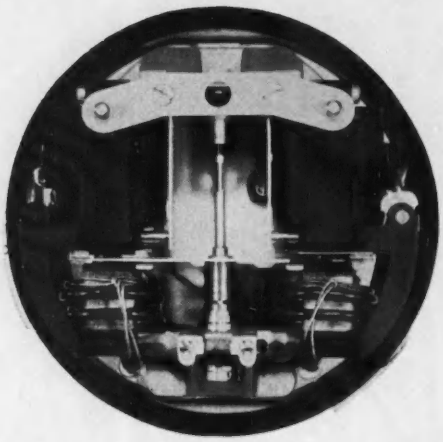
GENERAL ELECTRIC

LATTICE-TYPE ALUMINUM STRUCTURE used for station illustrated is light enough to be handled manually. Station structure was erected in one working day.

Meter Meeting Hears of New Developments



M-60 DEMAND REGISTER, designed by General Electric



P20 WHR METER, by Sangamo, has magnetic flotation

GE shows demand meter with conventional register dials; Sangamo extends magnetic flotation system to other lines

The fall meeting of the EE/AEIC Meter Committee will hear presentations today (Sept. 19) by representatives of General Electric Co and Sangamo Electric Co on new meter developments. The meeting is being held at the Westchester Country Club in Rye, N. Y.

GE's major innovation is a demand meter that replaces the usual sweep pointer and scale with a set of conventional kwhr-type register dials. On its part, Sangamo is announcing six new instruments incorporating the company's "true magnetic flotation system."

The new type M-60 demand register, GE claims, incorporates several new concepts in order to obtain the following user benefits:

- Motor with a maintenance-free life of 25 years;
- Elimination of the need for scale classes;
- Accuracy in terms of percent of the point being read and within ±1% of that point down to 5% of

(*Continued on page* 130)

Prodac Computer Will Control Sewaren's No. 5

First Westinghouse unit for automatic control of a generating station will be built for Public Service Electric & Gas

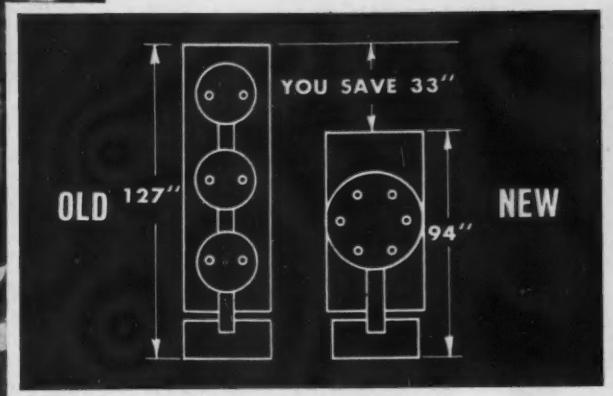
Westinghouse Electric Corp's new Prodac digital computer system will control operation of the 342-Mw generating plant Public Service Electric & Gas Co of New Jersey is building at the Sewaren generating station. Installation is scheduled to begin in late 1961 on Unit No. 5. The control system will become operational by early 1962.

The unit is the first control computer of its kind constructed by Westinghouse for automatic control of a generating station. It is also among the first applications of Prodac for industrial process control. Several of these computers are scheduled for process control in the steel industry before 1962.

Solid-state components will be used exclusively except for mercury-wetted relays used to switch inputs and outputs.

The computer will have the ability to start, operate, and shut down the boiler, turbine-generator, and plant auxiliaries in accordance with pre-established programs for both normal and abnormal conditions. Operating programs will be read into the computer control from punched tape, stored for use as needed in a memory unit, and executed according to computations based on process data received from hundreds of sensing points throughout the plant. The computer will be built to accommodate as many as 1,500 input signals from the sta-

(*Continued on page* 130)



Comparative dimensions of G-E one-tank and conventional three-tank breakers rated 34.5 kv, 1200 amps.

WITH GENERAL ELECTRIC ONE-TANK SUB-TRANSMISSION BREAKERS, YOU CAN . . .

Reduce Space Requirements and Installation Costs

Space requirements and installation costs are substantially reduced with General Electric one-tank sub-transmission breakers.

Because G-E breakers accommodate all phases in one tank, they weigh at least 700 pounds less than three-tank units of the same rating, and require 25% less space.

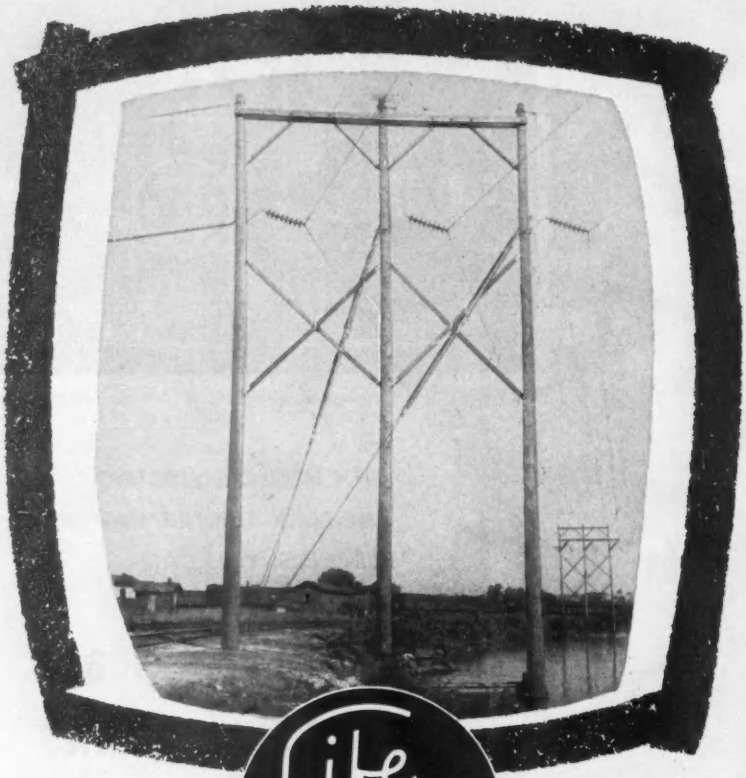
Compactness and light weight mean that G-E one-tank breakers can be mounted on smaller foundation pads, saving you material and excavation costs. Considerable savings in overhead buswork can often be realized, too.

General Electric one-tank breakers are shipped with all components in place—you need only position the breaker and make necessary service preparations.

Why settle for less? For more information on one-tank breakers (15 kv through 46 kv), contact your G-E Sales Engineer. Or write to Section 494-03, General Electric Company, Schenectady 5, N. Y.

Progress Is Our Most Important Product

GENERAL ELECTRIC

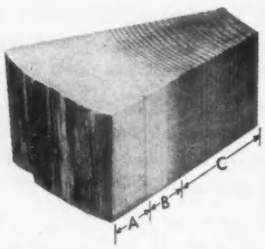


You can be sure when you install Life Span Western Red Cedar Poles!

... even where the most severe decay conditions exist

LIFE-SPAN'S thermal top-to-butt treatment permeates the ENTIRE sapwood... assuring longer pole-line service regardless of adverse installation or weather conditions. Besides being completely immune to decay, LIFE-SPAN Poles are clean, safe to climb and are carefully selected for uniformity and quality.

Want added years of pole-line service at far less per annum costs? Specify LIFE-SPAN Western Red Cedar Poles when you buy.



Actual laboratory tests **prove** ... pentachlorophenol permeates both inner sapwood and outer sapwood the LIFE-SPAN way, making it impossible for the sapwood to decay under the most severe conditions. The above is a section taken from a Western Red Cedar pole after **years** of actual pole-line service under adverse conditions. It shows **(A)** the outer sapwood, **(B)** the inner sapwood and **(C)** the heart wood—all in perfect condition.

PAGE & HILL, Inc.

Minneapolis 3, Minnesota

Prodac Computer

(*Continued from page* 128)

tion's instrumentation and control points. Eight different priority levels will be provided for assignment to various pre-established control actions.

The system will assimilate the output of instruments and relays at high scanning rates and will process this data and other data in storage to compute heat rates, boiler and system efficiencies and other indexes necessary to optimize plant operation. It will also log and display the status of all key plant functions periodically or upon the operator's command.

The computer control system will provide the station operator with close control of the unit at all times, but stored programs will cover all conceivable operating conditions and will apply to all main unit functions. Controls for the major analog-type sub-loops normally provided for plants of this type will be modified to permit complete integration with computer control. Many of these sub-loop control systems will be continuously monitored by the computer at the same time that it is performing calculations and issuing control signals for optimizing unit operations.

Meter Meeting

(*Continued from page* 128)

full scale reading.

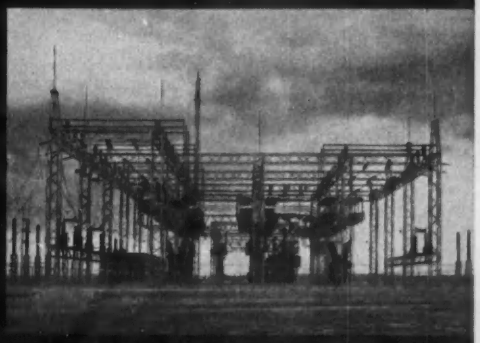
- Improved readability due to longer (190 in.) effective scale length provided by three kwhr-type dials.
- Elimination of need for adjustment to obtain correct calibration.

The time interval mechanism of the M-60 register (which replaces the M-30 register) consists of a motor mechanism combined with an M-30 Geneva mechanism and placed in an hermetically sealed enclosure with a specially developed silicone oil to provide permanent lubrication over the wide temperature ranges found in service. The reset motion is obtained from the rotor unit through sealed bellows.

The use of multi-pointer presenta-

(*Continued on page* 132)

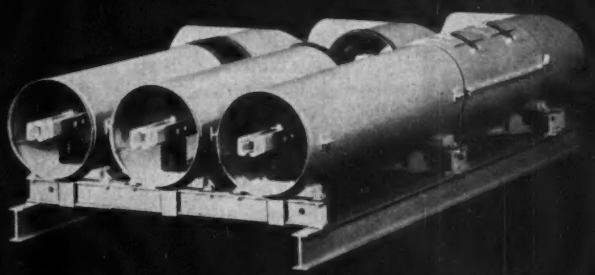
Single column of Type ATB air-blast power circuit breakers—115–460 kv.



Completely designed and coordinated outdoor stations—7.5–230 kv.

Single-tank sub-transmission breakers—14.4–46 kv.

Disconnect switches—7.5–345 kv.



Isolated phase bus—14.4–34.5 kv, through 20,000 amps.

GENERAL ELECTRIC OFFERS YOU A COMPLETE LINE OF HIGH-VOLTAGE SWITCHGEAR . . . . .

Why Settle for Less?

When you buy General Electric generation and transmission switchgear, you get one all-important benefit no other manufacturer can match—*outstanding added value.*

You Get Top Product Design—From giant 460-kv air-blast breakers to custom-tailored outdoor stations, General Electric high-voltage switchgear equipment is designed for easiest installation, top safety, optimum performance, and dollar-saving ease of maintenance.

You Get Results of Research—Important General Electric developments in the high-voltage switchgear field include:

- First single-tank, five-cycle outdoor sub-transmission breaker;
- First modern air-blast transmission breaker;
- First isolated-phase bus with conductors having a 105°C maximum hot-spot temperature.
- First computer-designed outdoor station.

You Get Nation-wide Service—G-E sales offices and service centers throughout the nation assure you of prompt, courteous application and installation assistance; also, fast, high-quality maintenance and repair service.

Why Settle for Less? Whether you want one disconnect switch, or a complete, custom-tailored switching station, with General Electric you get the *best* in switchgear. For information on specific equipments, contact your G-E sales engineer. Or send in the coupon below.

Progress Is Our Most Important Product

GENERAL ELECTRIC

General Electric Co.
Section J492-13
Schenectady 5, N. Y.

Send me detailed information on the following:

- ☐ High-voltage air-blast breakers
- ☐ Disconnect switches
- ☐ One-tank sub-transmission breakers
- ☐ Isolated phase bus
- ☐ Outdoor stations 7.5 to 345 kv

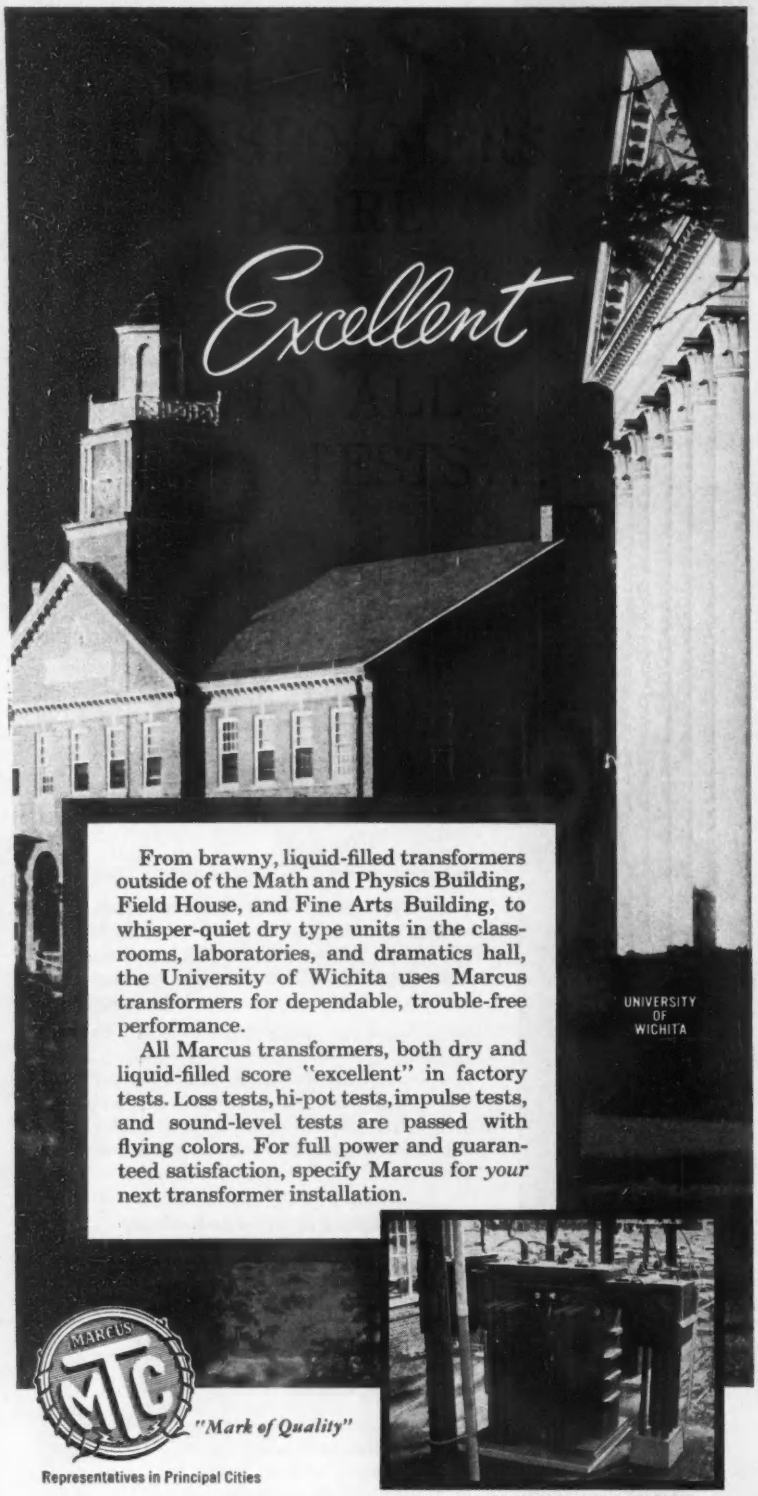
OTHER:_____

NAME_____ TITLE_____

COMPANY_____

ADDRESS_____

CITY_____ STATE_____



From brawny, liquid-filled transformers outside of the Math and Physics Building, Field House, and Fine Arts Building, to whisper-quiet dry type units in the classrooms, laboratories, and dramatics hall, the University of Wichita uses Marcus transformers for dependable, trouble-free performance.

All Marcus transformers, both dry and liquid-filled score "excellent" in factory tests. Loss tests, hi-pot tests, impulse tests, and sound-level tests are passed with flying colors. For full power and guaranteed satisfaction, specify Marcus for *your* next transformer installation.

1500 KVA OIL FILLED TRANSFORMER

MARCUS MTC "Mark of Quality"

Representatives in Principal Cities

MARCUS TRANSFORMER CO., Inc.

RAHWAY, NEW JERSEY

A COMPLETE LINE OF DRY TYPE AND LIQUID-FILLED TRANSFORMERS THRU 5000 KVA

(*Continued from page* 130)

tion of maximum demand, GE explains, allows combining the scale capacity of Class 6 with the scale resolution, readability, and accuracy of Class 1. To achieve the multi-pointer principle, GE says it is necessary to reset the three pointer pusher shafts back to zero and at the same time give them a memory so that the pointer pusher will retrace the same number of revolutions representing the present maximum demand before it again advances the maximum demand shafts. This is accomplished by a novel mechanical coincidence circuit that employs two sensing disks and the pointer pusher on the maximum demand shafts, as well as mating pins on the three running shafts.

GE says the M-60 demand register is expected to be available to utilities in the first quarter of 1961.

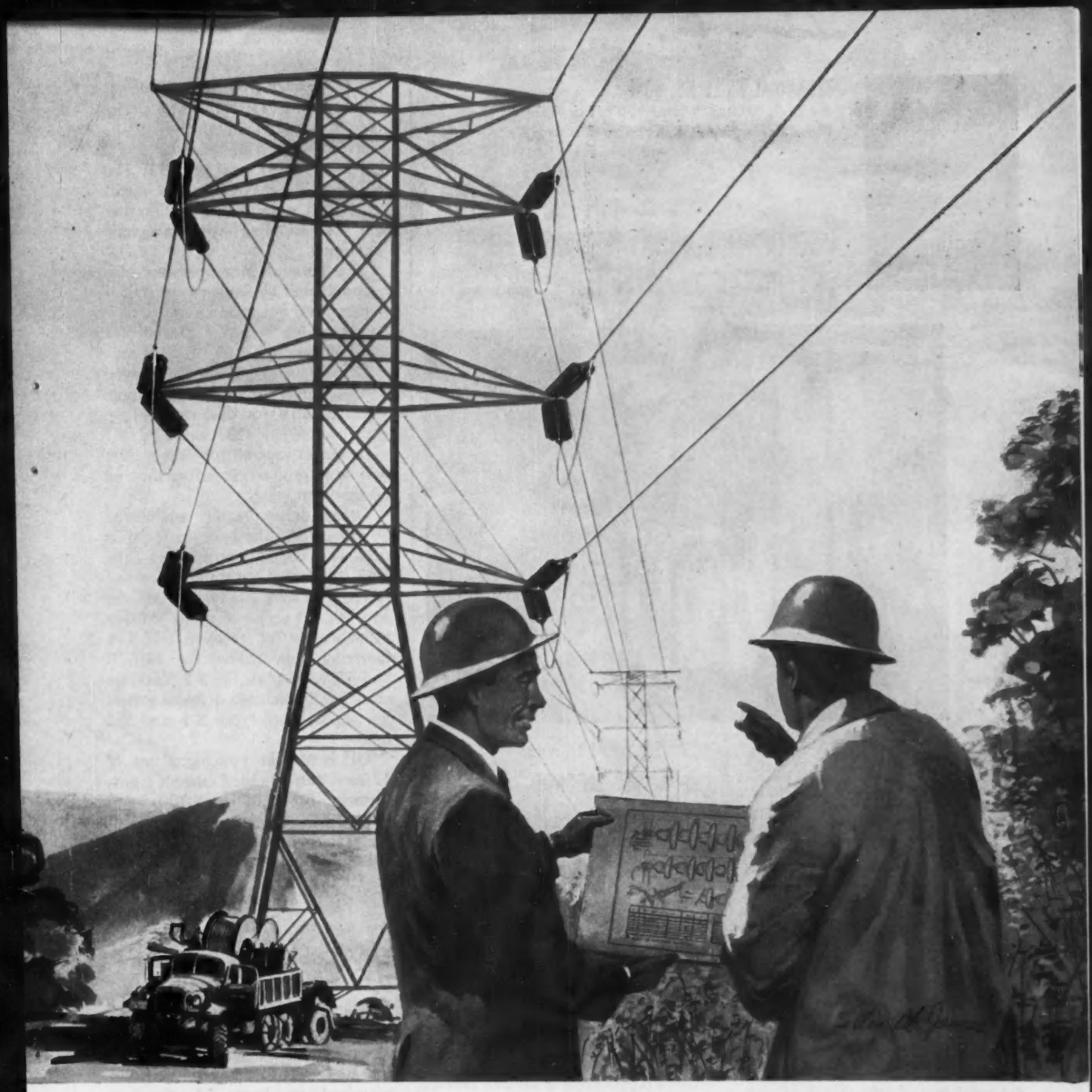
Sangamo's innovations include new P20 two-stator and P30 three-stator polyphase watthour meters. These supercede types P2 and P3 with the principal design change being the replacement of the ball and jewel bearing system with magnetic flotation. Sangamo says the new flotation system plus slow speed and high torque characteristics will further improve sustained accuracy of the company's polyphase meters.

The principle of design of the floating system is identical to that used in the J3 single-phase watthour meter announced earlier this year by the company. It consists of two cylindrical bonded Alnico magnets located below the disk and positioned so that their opposing magnetic fields float the moving element. The 1/20-in. gap between the magnets cannot be bridged by magnetic particles, Sangamo says, and is visible for inspection without removing the disk and spindle assembly.

The feature of sectionalized construction has been retained in the new meters, assuring interchangeability of parts of all type P polyphase meters, with the exception of the moving system.

All the new watthour meters can be equipped with the company's type D demand register designed for types J or P meters. The new watthour mechanical demand combinations will have the following designations: J3D, P20D, and P30D. In

(*Continued on page* 134)



INTEGRITY

Thirty-two VICTOR No. 924, 25,000 lb. suspensions (EEI-NEMA 52-5) yoked in two strings of sixteen each, carry the strain of this angle tower of Consolidated Edison's Yonkers to Millwood, N. Y. transmission line.

Design that has been proven in thousands of installations . . . quality controlled manufacturing that maintains complete uniformity of product . . . conscientious testing procedures that insure conformance to VICTOR's high standards . . . these are the reasons for VICTOR's enviable reputation for reliability of product and integrity of purpose.

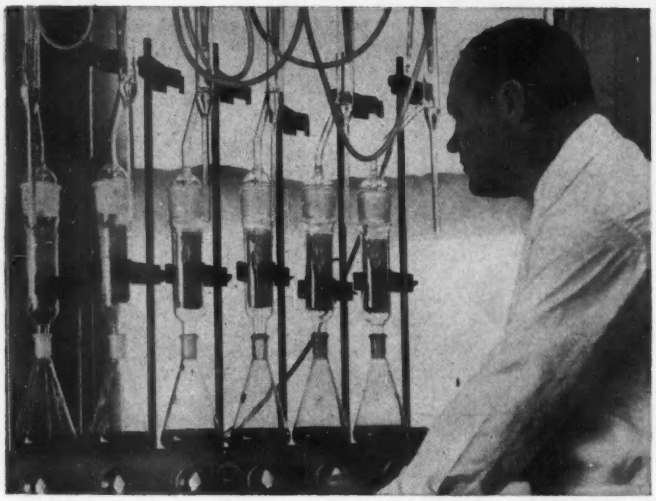
Best evidence of this integrity of purpose is the fact that VICTOR insulators consistently proof-test in excess of their EEI-NEMA ratings. You get more for your money by choosing VICTOR. For catalog, specifications and prices, contact your nearby VICTOR sales office, Victor Insulators Division, I-T-E Circuit Breaker Company, Victor, N. Y.

I-T-E CIRCUIT BREAKER COMPANY

TECHNICAL BRIEF NO. 60-1

By D. L. DAVIES, *Manager, Technical Dept. Wood Preserving Div., Koppers Company, Inc.*

USE OF THE ASSAY METHOD TO DETERMINE RETENTION IN POLES



PRESENT STATUS

The Assay Method of determining preservative retention in pole charges has been described in Koppers Technical Bulletins W-101 and W-102. Following is the status of the Assay Method as a replacement for the less accurate gauge method of determining preservative retention.

The Western Electric Company, Inc. over 2 years ago made the Assay Method a part of its specifications on all new pole contracts. This major specification change was adopted to eliminate "weak sister" charges — charges which meet standard specifications by other measurement tools, but which in reality do not contain sufficient preservative to provide long-lasting protection.

The Rural Electrification Administration in April, 1960 issued new specifications which make mandatory that determination of retention in poles be made by the Assay Method. Many REA utilities have suffered financial loss from premature pole failures. They, too, want to eliminate the "weak sisters".

The Federal Government has a tentative specification TT-W-571f, now being reviewed by industry, which also calls for the Assay Method for determining retention (without alternates) in both poles and piles.

The AWPA adopted the Assay Method for determining retention in poles as a "full standard" at the April 24-26, 1960 meeting.

HOW TO APPLY THE ASSAY METHOD

In applying the Assay Method to poles, the specifications require that the outside ½" of the pole section be discarded. This section usually contains about 14-lb. preservative per cubic foot. Specifications further require that the next 1½" be assayed for retention. Therefore, an 8-lb. normal gauge retention charge must have a minimum of 6-lbs. per cubic foot in this zone. A 10-lb. treatment must have 7½ lbs. and a 12-lb. treatment must have 9-lb. in the assayed zone. No undertreatment allowance is permitted. Adoption of these retention requirements represents the most significant advance in standards for pine pole treatment since the adoption of 2½" or 85% sapwood penetration requirement in the late 1930's.

ANY COMPANY CAN ADOPT THE ASSAY METHOD

The status of the Assay Method for determining retention has advanced to the stage that any company can adopt it by a simple notation on the purchase order specifying that "poles are to be treated to a retention of *x* pounds/cubic foot as determined by assay".

• • • • • • • • • • • •

For the full report on using the Assay Method, or answers to technical questions on poles or pole treatment, write: Koppers Company, Inc., Wood Preserving Division, Technical Dept., Room 748, Koppers Building, Pittsburgh 19, Pa.

C-45

KOPPERS
PRESSURE-TREATED WOOD

(*Continued from page* 132)

addition, the J3 and P20 meters have also been combined with the Lincoln demand meter. Thus, the J2T is superceded by the J3T. The PW polyphase combination meter retains its present designation but will be supplied with magnetic flotation.

The flotation principle has also been adapted by Sangamo to single-phase watthour meter-time switch combinations which are used for automatic control of off-peak circuits. The new instruments, type J3M designed for single-rate billing, and type J3V for dual-rate billing, supercede types J2M and J2V.

Sangamo says all the new meters will be in production before the end of this year.

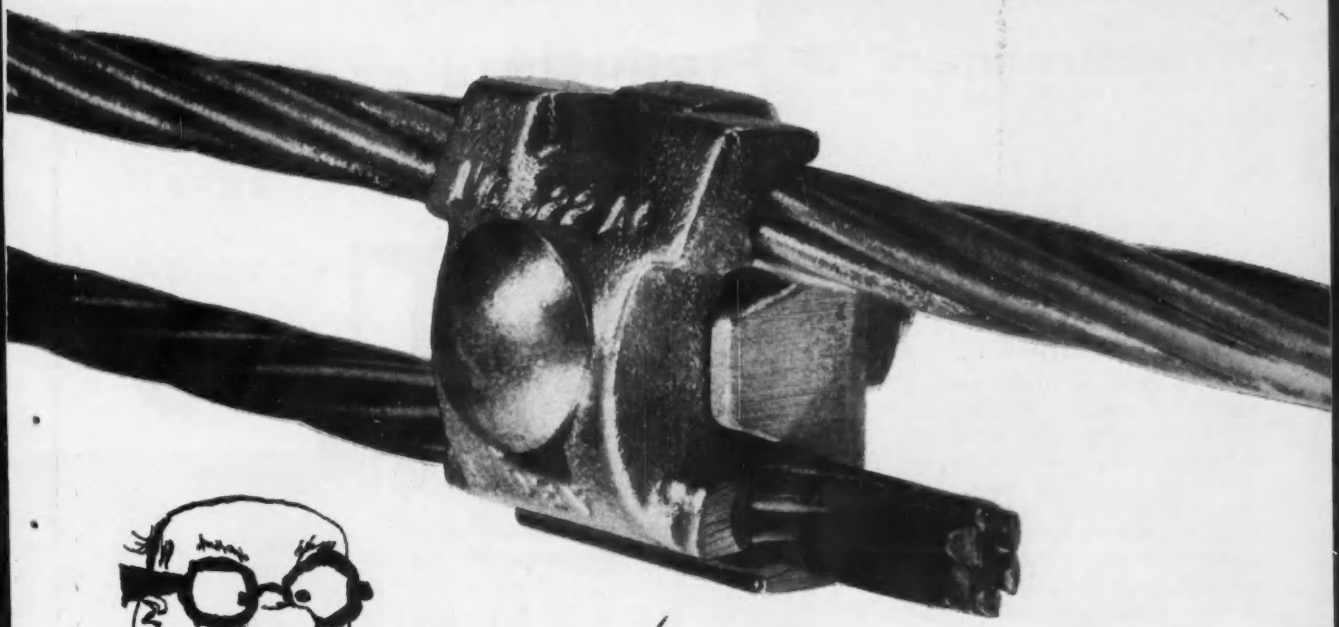
Other developments announced by GE include the I-63 single-stator network meter superceding the I-62, the automatic billing demand metering system PD-60, the MC-50 and MC-60 series of phase-shifting transformers for reactive and kva metering superceding the MC-20 and MC-30 series, the S-3 auxiliary relay for multicircuit demand metering superceding types S-1 and S-2 relays.

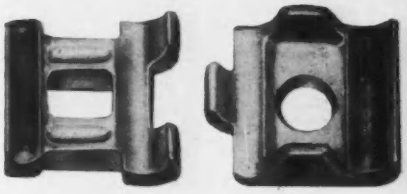
GE is also introducing a line of 12 new butyl-molded current transformers for 5,000-, 8,700- and 15,000-volt service in ratings of 1,200 to 4,000 amp. Expected availability is during the fourth quarter of 1960.

EHV Cable Test Program Underway at Cornell

The extra-high-voltage cable field testing program at Cornell University, under the auspices of AEIC and EEI, was formally opened and energized on Sept. 14. Original date set was Jan. 1, 1960.

Manufacturers and service companies participating are General Cable Corp, Okonite Co, Phelps-Dodge Copper Products Corp, Anaconda Wire & Cable Co, General Electric Co, Johns-Manville Sales Corp, Joslyn Mfg & Supply Co, Lapp Insulator Co, R&IE Equipment Div of I-T-E Circuit Breaker Co, Ohio Brass Co, Southern States Equipment Co, Evanite Plastic, Underground Products, W. A. Chester, Inc, and Westinghouse Electric Corp.





Bonded Copper Liners Eliminate Corrosion

in Aluminum-to-Copper Connections

During the past 30 years, more Anderson aluminum-to-copper connectors have been used than any other brand! Why? Look to the liners.

- Unique metallurgical bonding method intimately joins copper liners to aluminum connector grooves.
- Bonded copper liners prevent direct aluminum-copper contact, provide a low resistance current path, eliminate corrosion.
- Resilient bond equalizes dissimilar expansion of the aluminum and copper.
- High strength aluminum alloy clamp insures high pressure connections.
- Interlock fingers guide proper alignment during installation.

No wonder, as our mad scientist Andy says, "They're used by the millions!" See your Anderson man soon for details.

ANDERSON ELECTRIC CORPORATION • BIRMINGHAM 1, ALABAMA

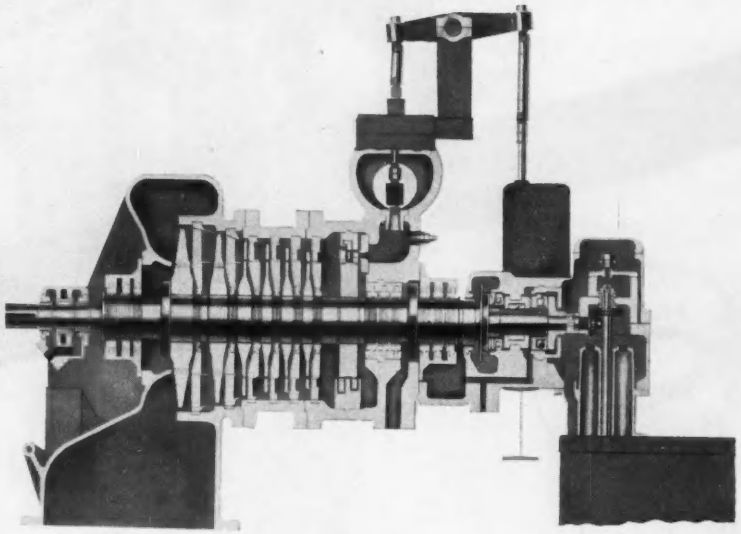
ANDERSON ELECTRIC

Research / Quality / Performance / in Aluminum and Bronze Products

Small Turbines . . .

. . . with speeds to 16,000 rpm are available in five frame sizes and ratings to 32,000 hp. The line of turbines has been extended to include multistage units with wheel diameters 12 to 32 in. All sizes are designed for 1,500-psig, 950F steam; 2,400-psig, 1,050F units can be supplied. Exhaust pressures can be from 1 in. Hg to 300 psig for most sizes.

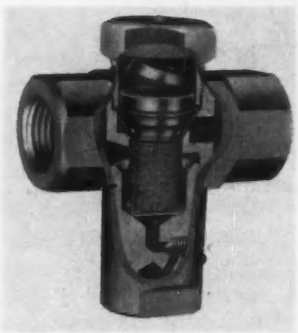
Westinghouse Electric Corp, Box 2099, Pittsburgh 30, Pa.



Anchors . . .

. . . are lightweight for easy handling and installation. These self-seating dome-plate anchors are for heavy distribution and transmission-structure guying and are furnished with or without clipped corners.

Jasper Blackburn Corp, 1525 Woodson Rd, St. Louis 14, Mo.



Steam Trap . . .

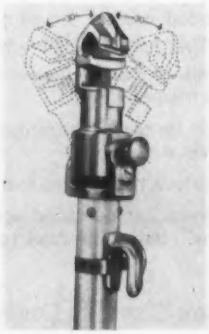
. . . with strainer and blowdown valve combined in the same body with the trap requires only two connections for the whole assembly. The Yarway No. 130 impulse steam trap is for light condensate loads with steam pressures of 8-600 psi. The integral blowdown valve is placed ahead of the strainer and trap.

Yarnall-Waring Co, 100 Mermaid Ave, Philadelphia 18, Pa.

Jumper Holding Tool . . .

. . . has an adjustable head that can be positioned 30 deg either side of center. The adjustable head enables good control and easy handling of slack conductors. The head is of aluminum alloy.

James R. Kearney Corp, 4236 Clayton Ave, St. Louis 10, Mo.

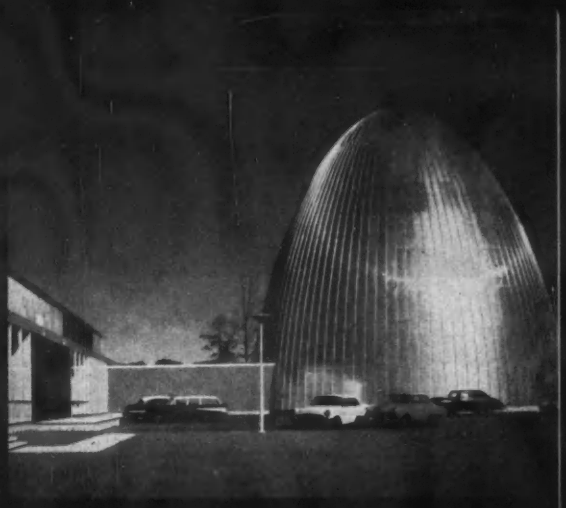


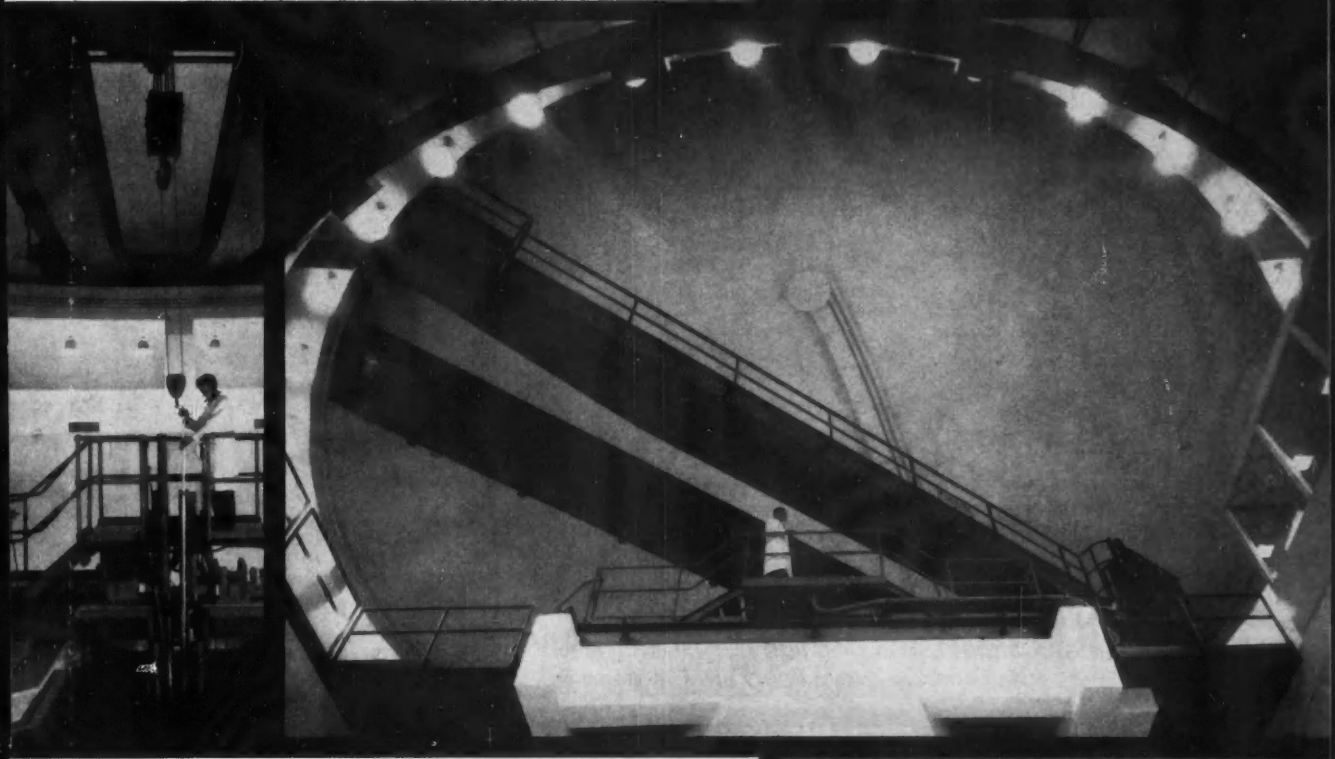
(*More New Equipment on page* 138)

Holophane Lighting

Keeps Pace with the Advances of Industry

SKIDMORE, OWINGS & MERRILL, Architects
GUY B. PANERO ENGINEERS, Cons. Engrs.
EMERSON-GARDEN ELECTRIC CO., Contractors





LOBAY Mercury Reflectors Light Industrial Reactor Laboratories

Twelve important companies have coordinated their resources for experimenting with nuclear radiation in industry at Industrial Reactor Laboratories, Plainsboro, N. J. . . . HOLOPHANE LOBAY Prismatic Reflectors were selected to light the pool reactor area because they provide many unique advantages. Their deep shielding prevents reflection from the pool. Prismatic design produces high level illumination with low brightness. At the same time, their upward component affords balanced, overall luminosity. Excellent light distribution permits best control of the reactor in the shaft . . . One more example of the way that HOLOPHANE controlled lighting meets specific needs.

Holophane
No. 635
LOBAY

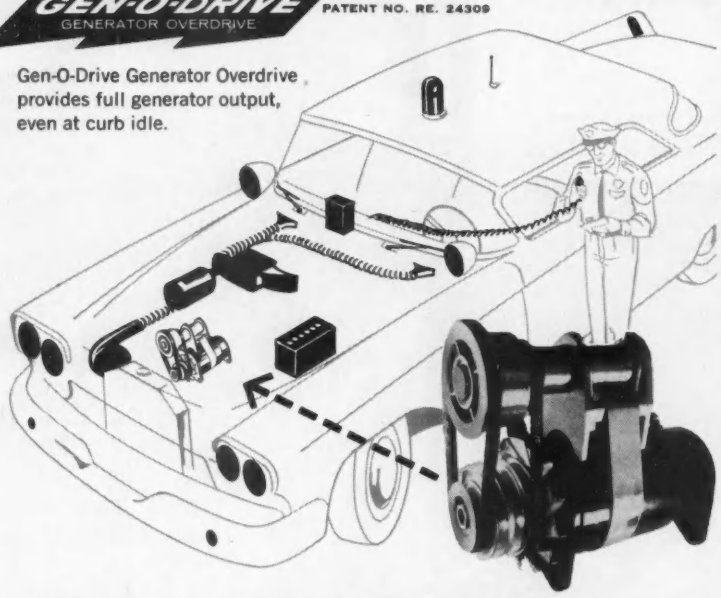
You are invited to consult HOLOPHANE engineers through your professional advisors.

HOLOPHANE
COMPANY, INC. • *Lighting Authorities Since 1898*
342 Madison Ave., New York 17, N.Y.
THE HOLOPHANE CO., LTD., 418 KIPLING AVE. SO., TORONTO 18, ONTARIO

FULL ELECTRICAL POWER
at any engine speed!

GEN-O-DRIVE® GENERATOR OVERDRIVE PATENT NO. RE. 24309

Gen-O-Drive Generator Overdrive provides full generator output, even at curb idle.



KEEPS BATTERIES CHARGED!

End battery-generator breakdowns. New improved-model GEN-O-DRIVE offers efficient, dependable service. Assures maximum battery charge at any speed, *even with all accessories operating!*

Slow speed, long idling periods, sirens, warning lights . . . nothing can drain your battery. GEN-O-DRIVE gives top generator output. Prevents rundown batteries, cuts maintenance and costly replacement.

Economical! GEN-O-DRIVE needs no periodic service. Lubricated for life! No battery replacement . . . extends battery life. Full guarantee.

NOW! TWO SOURCES OF POWER FROM ONE GENERATOR!

Watt Power® AC-DC GENERATOR Patent No. 2,939,975

WATT POWER AC-DC GENERATORS fit all F-L-M, D-R, Autolite systems. Provide normal DC and up to 1200 watts of 110-volt AC current!

RETURN COUPON FOR FULL DETAILS

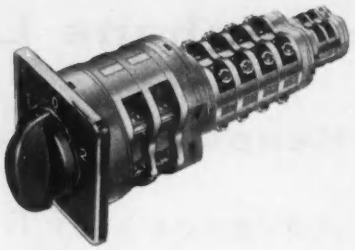
CONSOLIDATED GENERAL PRODUCTS, INC.
P. O. Box 7425C, Houston 8, Texas

Send complete information on: ☐ Gen-O-Drive ☐ Watt Power Generators

Name_____

Address_____

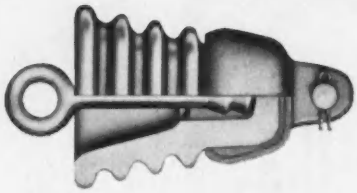
City_____ State_____



Modular Switch . . .

. . . is built up of stages, each of which has up to four double-break silver-alloy contacts. As many as 12 stages can be mounted in a column. All but those parts meant to carry current are of insulating material. The Blue Line switches are furnished in ratings from 20 to 200 amp, 600 v ac.

American Solenoid Co, Inc, US Highway 22, corner of Madison Ave, Union, N. J.



Strain Insulator . . .

. . . for dead-ending is slightly longer than a 6-in. conventional insulator, but does the job of two 6-in. or a 10-in. unit. The rugged strain insulator's tubular contour makes it hardy for handling and its small diameter makes it easy to cover for hot-line work. It is for circuits to 12.47 kv.

Delta-Star Electric, 2437 Fulton St, Chicago 11, Ill.

Hydraulic Derrick . . .

. . . can be mounted on the front of a line truck. The model DHDS swivel tail hydraulic derrick so mounted affords lateral movement and good weight distribution on 4x4 trucks for good traction off the pavement.

Utility Body Co, 1530 Wood St, Oakland 7, Calif.

UNIVOLT® 35 TRANSFORMER OIL

Superior Insulation—proved in use!

UNIVOLT 35 is excellent as an insulating and cooling medium. It serves so well because of its high oxidation stability, low power factor, freedom from acid, alkali and corrosive sulfur, and compatibility with the varnish finishes of coils. Its superior heat resistance properties make it particularly effective even under peak loads during the summer due to air conditioning.

Refined from carefully selected, high quality straight mineral oil, Univolt 35 is shipped to you with utmost care in handling. The tank cars used are specially prepared and inspected, and all loading is done indoors to prevent contamination.

Univolt N 36—a transformer oil possessing all the characteristics of Univolt 35 plus an efficient oxidation inhibitor — is also available.

For complete information, contact your nearest Esso office, or write: Esso Standard, Division of Humble Oil & Refining Company, 15 West 51st Street, New York 19, New York.

Esso

In Industry after Industry..."ESSO RESEARCH works wonders with oil"

BETTER REGULATION
10
Standard

MEANS INCREASED REVENUE

• Now the advanced design features of the Standard type SWA low impedance distribution transformer put the power at the meter by radically cutting losses . . . EVEN AT PEAK LOAD. This increased transformer efficiency gives you three-way profit . . . fewer customer complaints about service . . . better voltage at entrance switch . . . more of manufactured energy metered . . . and increased return per kwh produced. Copper losses alone have been cut as much as a whopping 30% at full load! What would that mean on your system?

Load-building to meet peaks brings on another problem met head-on by the SWA—overload. With the Standard SWA, improved thermal time constant permits overload without excessive heating or excessive voltage drop. You have fewer burnouts . . . fewer costly changeouts.

This is the greatest advance in distribution transformer design and efficiency since the introduction of grain-oriented steel. It was FIRST AT STANDARD.

Your nearby Standard representative can show you what the all-new SWA means on your complete system or on any division of it. Get the facts from him today.

WRITE FOR Standard Bulletin S-401-C. It gives complete information on the SWA and shows how it will help increase your revenues. We'll send it by return mail.

40 years of concentration on transformer design exclusively

Phone WARREN
EXpress 2-1563

Standard Transformer CO.
WARREN, OHIO
"WHEREVER THERE IS POWER"

Time Pay Wiring Plan Pleases Everyone

C. P. KOMMERS, Residential Sales Supervisor, Montana Power Co, Butte, Mont.

A promotional rewiring campaign, Time Pay Wiring, conducted by Montana Power Co, has resulted in substantial increases in residential accounts.

Average annual increases of 961 kwhr (29.2%) and $18.70 (23.4%) in revenue per installation (see box below) compare to the system's average customer annual increase of 185 kwhr and $5.46 over the last four years.

But figures are only a part of Time Pay Wiring for the campaign benefits apply to everyone.

• The customer likes the procedure because he is generally unfamiliar with wiring contracting practices and this plan eliminates confusion and makes the final decision easier.

• The contractor likes it, even though he might have to bid for the job, because he knows his competitors are bidding on the same plan and specifications. And, on Time Pay jobs the contractor gets his money immediately.

• Our company likes the plan because the entire program has helped upgrade wiring standards. Also each job is installed according to the American Standard Practices for Residential Wiring, the National Electrical Code and local ordinances.

The campaign itself revolves around 14 full-time and 12 part-time service advisors actively engaged in customer contact selling Housepower.

Initiated in 1956, the advisory service offers consultation advice to the customer in his own home. After a preliminary, on-the-spot discussion with the homeowner, the service advisor draws up a prospective wiring plan for the home, with an estimated cost figure. If the customer approves the plan a contractor is called in.

Who the contractor shall be is determined by the customer. Where there is no preference, jobs are assigned on a rotation basis. If bidding is desired, the customer determines who will be invited. The utility does all the contact work which facilitates completion of the job to the satisfaction of everyone.

Financing is arranged so that the customer may pay upon completion of the wiring or through the special Time Pay Wiring Plan. This special plan is carried out through payments on the monthly utility bill. In either case, the contractor is paid upon completion of the job.

Since the program's beginning, the service advisors have made 6,692 residential wiring plan layouts to date (on paper) which have resulted in 7,090 installations. The higher number of installations is because of several installations resulting from one layout, such as in a tract.

A survey of the results from the Time Pay Wiring Plan accounts, for the 12 months before and the 12 months after the rewiring, was made to determine the average benefit to the utility (see box). No attempt was made to find out *why* the customer rewired.

The figures represent general increased usage, as electric heat was not promoted.

Another useful comparison might

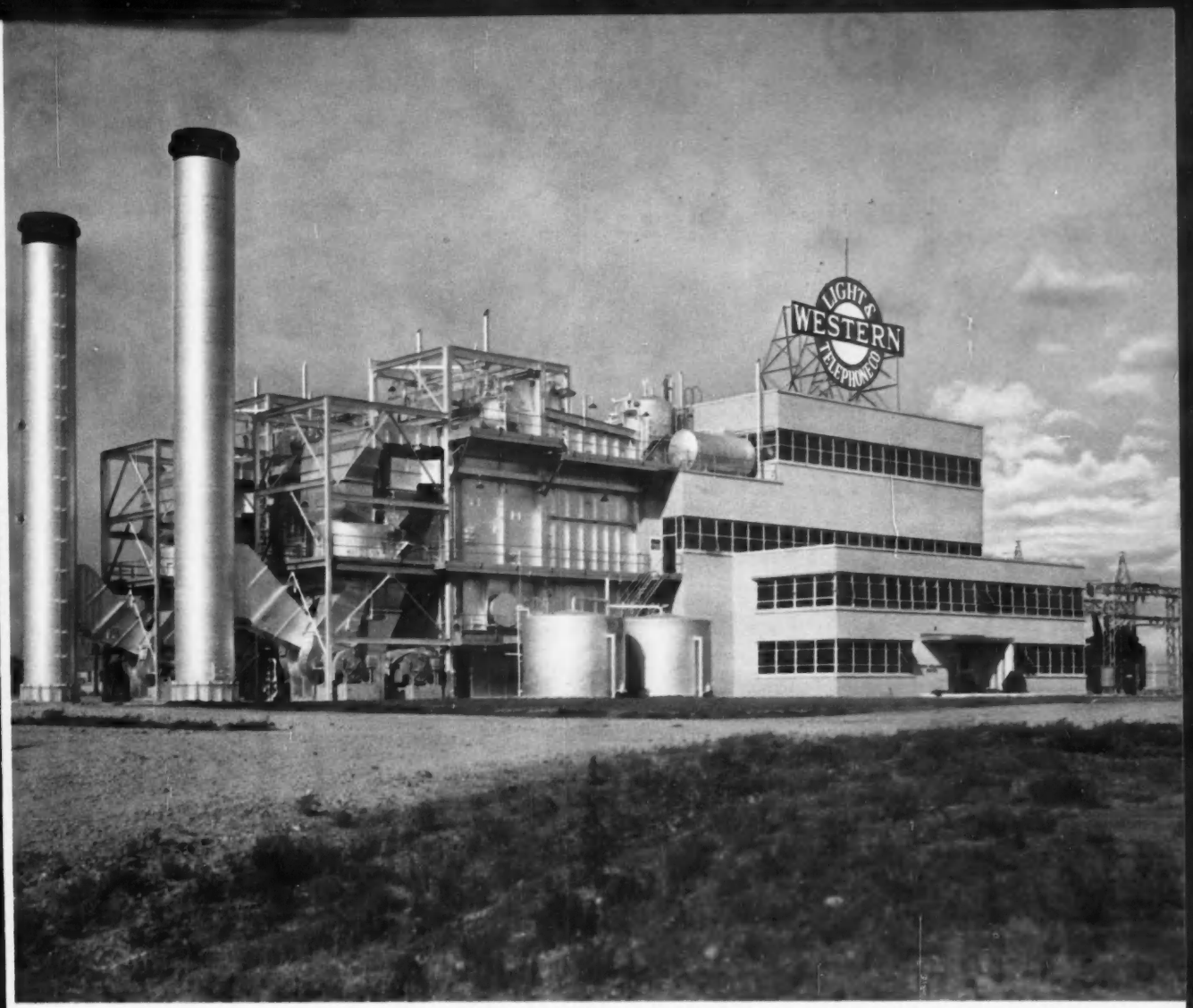
(*Continued on page* 145)

Time Pay Wiring Installations–Consumption and Revenue Before and After Rewiring (12-Month Periods)

Divisions	Installations Reported	Annual Kwhr Before	Annual Revenue Before	Annual Kwhr After	Annual Revenue After	Annual Kwhr Gain	Kwhr % Gain	Annual Revenue Gain	Revenue % Gain
Billings	258	948,942	$22,831.63	1,143,874	$ 26,472.64	194,932	20.5	$3,641.01	15.9
Bozeman	58	214,617	4,882.49	322,254	6,693.21	107,637	50.1	1,810.72	37.0
Butte	246	599,534	16,170.07	925,503	22,734.35	325,969	54.3	6,564.28	40.5
Great Falls	522	1,805,700	42,729.00	2,193,684	50,658.72	387,984	21.4	7,929.72	18.5
Helena	52	156,922	3,933.83	231,714	5,232.01	74,792	47.6	1,298.18	33.0
Missoula	4	15,220	373.97	19,268	446.53	4,048	26.5	72.56	19.4
Total	**1,140***	**3,740,935**	**$90,920.99****	**4,836,297**	**$112,232.46****	**1,095,362**	**29.2**	**$21,316.47**	**23.4**

Total annual kwhr (after)	4,836,297	Total annual revenue (after)	$112,237.46
Total annual kwhr (before)	3,740,935	Total annual revenue (before)	90,920.99
Total annual kwhr—gain	1,095,362	Total annual revenue—gain	21,316.47
Average annual kwhr gain per installation	961	Average annual revenue gain per installation	18.70
Annual kwhr increase (%)	29.2%	Annual revenue increase (%)	23.4%

* Time Pay jobs reported since start of program in 1956—1188
Time Pay jobs for which records were available—1140
** Not adjusted for effect of rate increase July, 1958.



ARTHUR MULLERGREN GENERATING STATION WESTERN LIGHT & TELEPHONE COMPANY, INC. *40,000 kw—2 Units*

Power in Kansas...

Kansas is growing! Increasing population, diversified and expanded industrialization, oil and gas activity, petrochemical developments and expanded agricultural and livestock production all signify a progressive state. Each of these factors is evidenced in the west-central section of Kansas served by the Western Light & Telephone Company, where demand for electric power is one of the most effective barometers indicating growth. In their area, kilowatt-hour consumption has increased 156% during the past 10 years. Population in the principal communities supplied has increased over 27% in the same period with some showing rates of 80% or more. To meet the electrical power requirements of this growing area, Western Light & Telephone Company engaged in a farsighted building program and tripled its generating capacity in that same 10 year period.

FULL COLOR BROCHURE outlining the scope of Sargent & Lundy services will be sent on request.

SARGENT & LUNDY
ENGINEERS

140 SOUTH DEARBORN STREET, CHICAGO 3, ILLINOIS

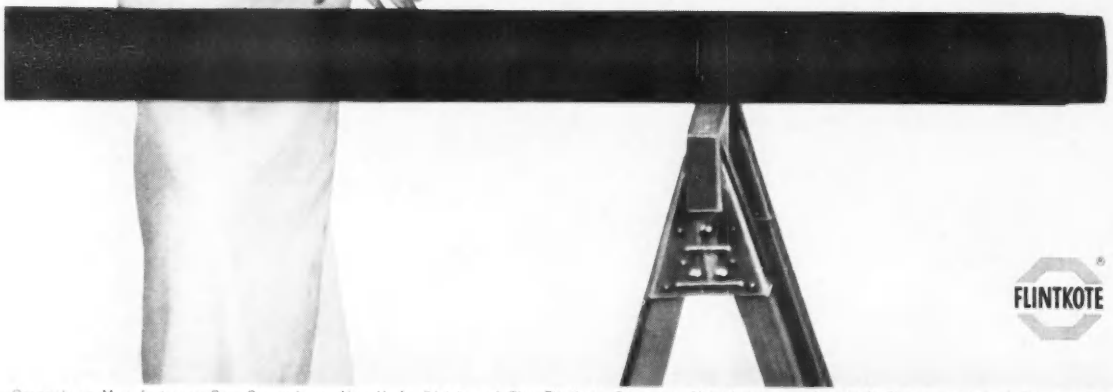
Announcing an exclusive new development in fibre conduit

A development of Orangeburg and Flintkote Research Laboratories, new *klean-kote* Orangeburg Fibre Conduit has a tough, non-brittle protective coating for cleaner, safer handling. To you and your men, this literally means cleaner hands, cleaner clothes and little or no chance of irritation. In addition, new *klean-kote* travels better, weathers better—and makes a stronger-than-ever joint.

Nothing has been changed in the traditional fine quality of the Orangeburg product. New *klean-kote* is just what the name implies – *a clean coating*. Beneath it lies the same quality product, manufactured with the same painstaking care which has made Orangeburg the best-known, best-selling line in America. Ask your wholesaler to show you a length of new *klean-kote* Orangeburg now.

Cleaner hands **Cleaner clothes** **No irritation**

klean-kote* **ORANGEBURG®** ***Fibre Conduit***



FLINTKOTE®

Orangeburg Manufacturing Co., Orangeburg, New York. Division of The Flintkote Company, Manufacturer of America's Broadest Line of Building Products

*KLEAN-KOTE IS A TRADE-MARK, U. S. PATENT APPLIED FOR. ORANGEBURG KLEAN-KOTE IS DISTRIBUTED BY GRAYBAR ELECTRIC CO. AND GENERAL ELECTRIC SUPPLY CO. WITH BRANCHES AND STOCKS IN PRINCIPAL CITIES.

Time Pay Wiring Plan

(*Continued from page* 142)

be to determine the rate of increased consumption three to four years from now from these same accounts, compared to average growth of the average customer throughout the entire system over the same period.

Also, the many other customers who rewired with service advisor help, but financed the job independently, are not included.

Housewife Disenchanted With Appliance Industry

Fifteen years ago when women talked about appliances they "bubbled." Today they just "grumble."

Why?

Daniel A. Packard, vice president and marketing director of Geyer, Morey, Madden & Ballard advertising agency, thinks he has some of the answers.

Talking to the recent National Appliance and Radio-TV Dealers Association's Institute of Management, Packard said the American housewife is disenchanted with the appliance industry. She is disgusted with appliance servicing, confused by appliance advertising, and dissatisfied with salespeople, he said.

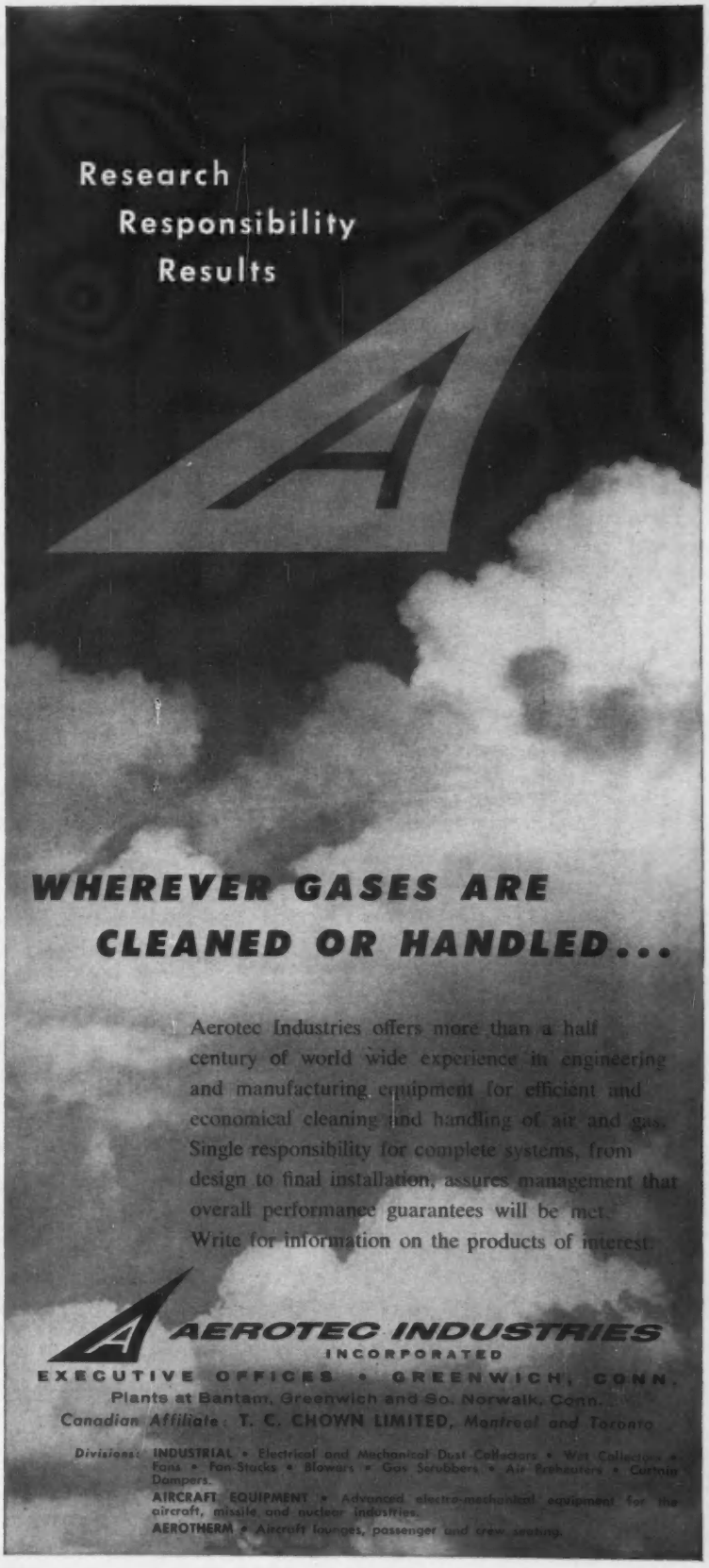
He credited manufacturers, however, with sensing this "consumer revolution" and being concerned about the consumer attitude toward service. They are "working around the clock to bring better quality, more trouble-free appliances," he said.

Several manufacturers also seem to be trying to give retailers better training material, he noted.

But, although retailers' major appliance advertising shows considerable improvement over the past 18 months, a study of advertisements reveals about 40% are still on "name, picture, price only."

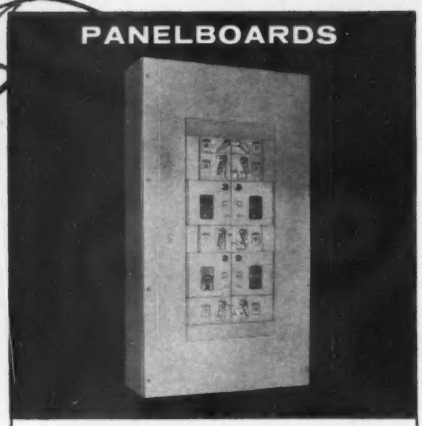
Packard called for better treatment of the customer on the retail sales floor; improved servicing, especially in the attitude toward the customer's problem; and a sustained effort to retain her once advertising

(*Continued on page* 148)

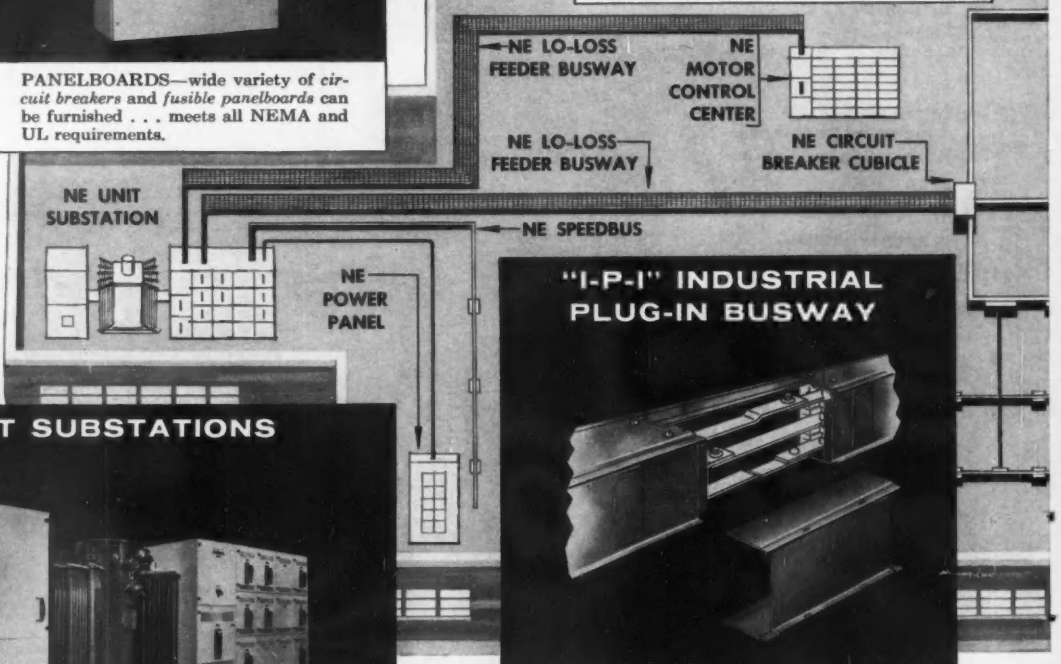

Research
Responsibility
Results
WHEREVER GASES ARE CLEANED OR HANDLED...
Aerotec Industries offers more than a half century of world wide experience in engineering and manufacturing equipment for efficient and economical cleaning and handling of air and gas. Single responsibility for complete systems, from design to final installation, assures management that overall performance guarantees will be met. Write for information on the products of interest.
AEROTEC INDUSTRIES
INCORPORATED
EXECUTIVE OFFICES • GREENWICH, CONN.
Plants at Bantam, Greenwich and So. Norwalk, Conn.
Canadian Affiliate: T. C. CHOWN LIMITED, Montreal and Toronto
Divisions: INDUSTRIAL • Electrical and Mechanical Dust Collectors • Wet Collectors • Fans • Fan Stacks • Blowers • Gas Scrubbers • Air Preheaters • Curtain Dampers.
AIRCRAFT EQUIPMENT • Advanced electro-mechanical equipment for the aircraft, missile and nuclear industries.
AEROTHERM • Aircraft lounges, passenger and crew seating.

NEW...NATIONAL ELECTRICAL

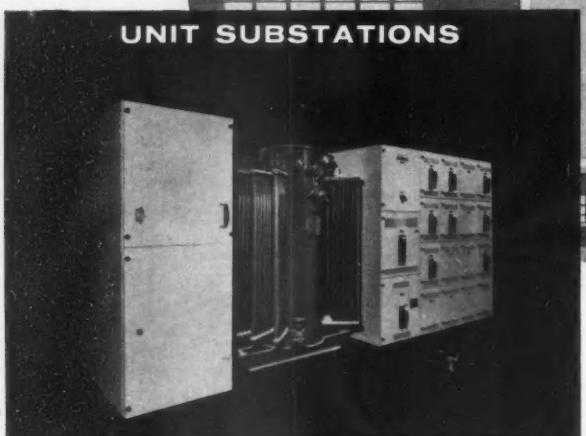
SWITCHBOARDS—complete range in NEMA Groups I, II, and III . . . also available in low-voltage metal enclosed *Switchgear*.



PANELBOARDS—wide variety of *circuit breakers* and *fusible panelboards* can be furnished . . . meets all NEMA and UL requirements.



"I-P-I" INDUSTRIAL PLUG-IN BUSWAY—up to 1500 amps at voltages up to 600 . . . versatile and time-tested . . . complete range of take-off and protective devices.



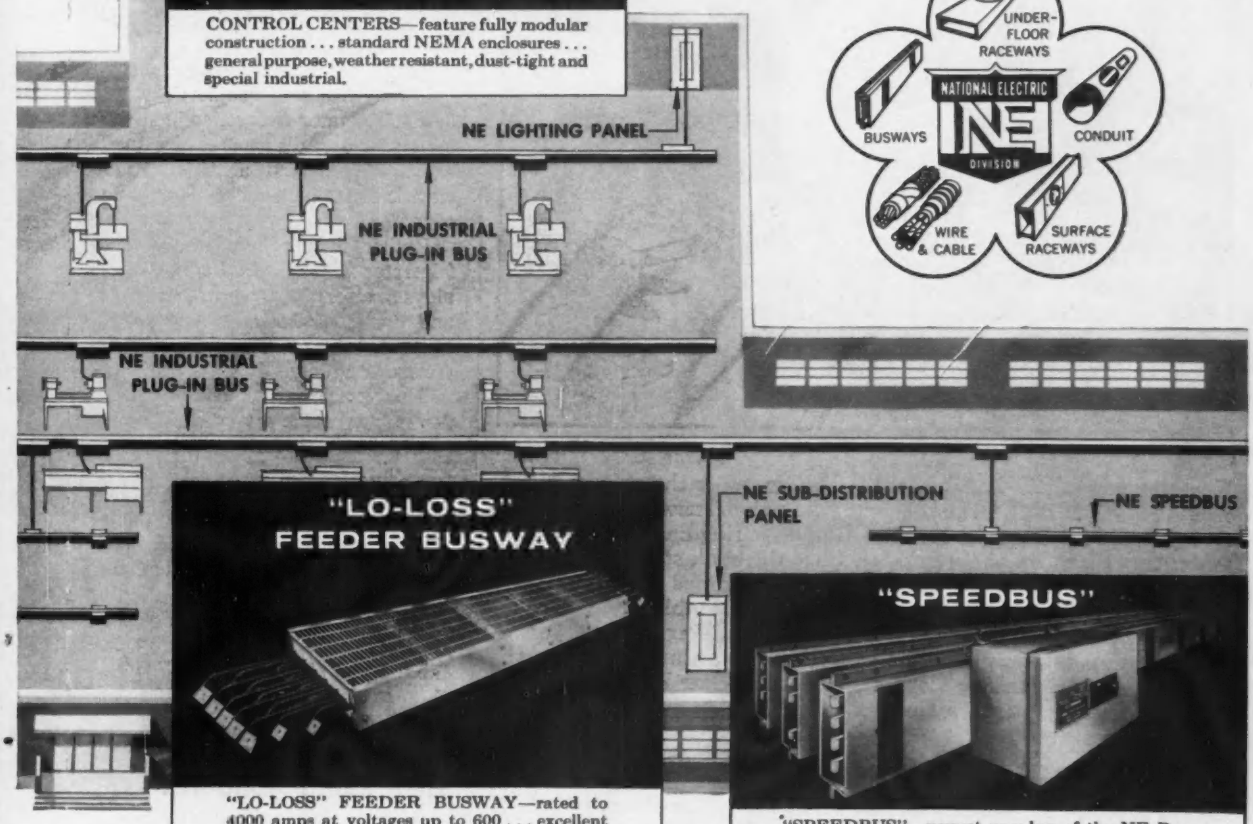
UNIT SUBSTATIONS—available as packaged units in Group I (600 Volts) and Group II (5 and 15 KV) . . . special and custom arrangements can be supplied.

ELECTRIC OFFERS COMPLETE DISTRIBUTION SYSTEMS

Time-tested National Electric busways are now combined with a new line of high quality switchboards and panelboards to provide complete systems to meet every plant's power and lighting distribution requirements.

For further information about all the advantages of our one-source service ask N-E Man, or write for complete catalog on National Electric Distribution Systems. Address: *National Electric Division, H. K. Porter Company, Inc., Porter Building, Pittsburgh 19, Pennsylvania.*

CONTROL CENTERS—feature fully modular construction . . . standard NEMA enclosures . . . general purpose, weather resistant, dust-tight and special industrial.



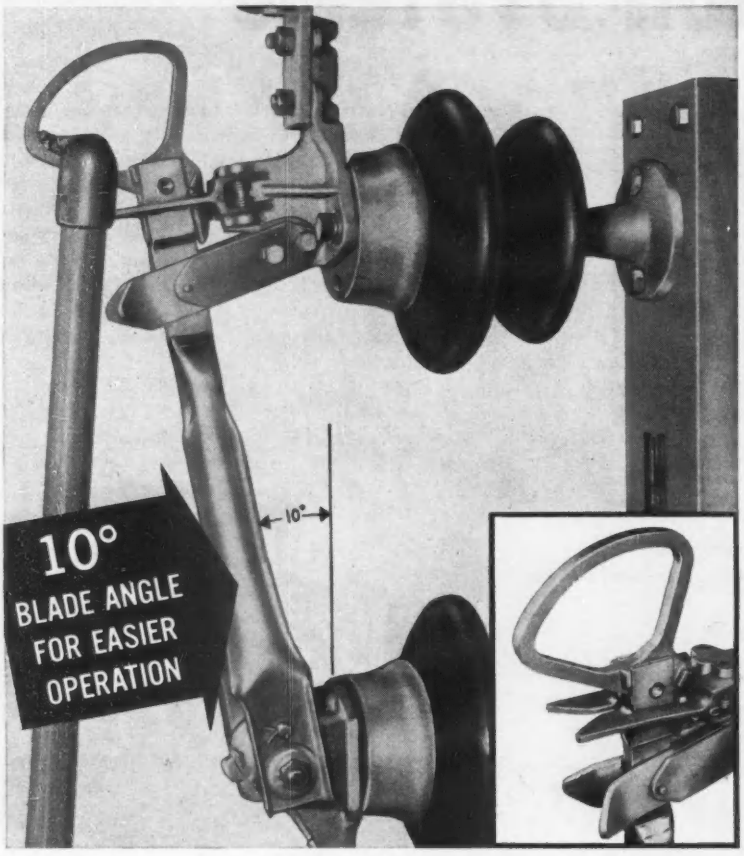
"LO-LOSS" FEEDER BUSWAY—rated to 4000 amps at voltages up to 600 . . . excellent electrical transmission characteristics . . . keeps voltage drop to a minimum.

"SPEEDBUS"—newest member of the NE Busway family . . . designed and priced to be used in lieu of conduit and wire.

NATIONAL ELECTRIC DIVISION PORTER **H. K. PORTER COMPANY, INC.**

PORTER SERVES INDUSTRY with steel, rubber and friction products, asbestos textiles, high voltage electrical equipment, electrical wire and cable, wiring systems, motors, fans, blowers, specialty alloys, paints, refractories, tools, forgings and pipe fittings, roll formings and stampings, wire rope and strand.

NEW Delta-Star B-2L Hook Stick Switch



The simpler, stronger design of the new Delta-Star B-2L Hook Stick Switch makes it the most reliable isolating switch on the market. New contact and hinge design minimizes current interchange surfaces, and provides lateral latching. Blade is rigid-formed hard-drawn copper tubing. Copper shoes have silver inlays for silver-to-copper contacts.

Operation of the new B-2L is easier—too. The 10° blade angle makes it easier to pull the blade—especially when the operator is directly under the switch.

Additional new features include the hook ring design, which positions the hook stick, and integral terminal clamps for ¾" IPS and 500 MCM cable, plus NEMA standard drilling for lugs.

For full information on the new Delta-Star B-2L Hook Stick Switch, which meets NEMA and AIEE standards, consult your Delta-Star representative or write to *Delta-Star Electric Division, H. K. Porter Company, Inc., 2437 Fulton St., Chicago 12, Illinois.*

DELTA-STAR PORTER **ELECTRIC DIVISION**

H. K. PORTER COMPANY, INC.

PORTER SERVES INDUSTRY with steel, rubber and friction products, asbestos textiles, high voltage electrical equipment, electrical wire and cable, wiring systems, motors, fans, blowers, specialty alloys, paints, refractories, tools, forgings and pipe fittings, roll formings and stampings, wire rope and strand.

(*Continued from page* 145)

has brought her into the store. He said most customers want, more than anything else, more information about what the product will do for them better than their old one.

He also pointed out that although there were tremendous appliance sales opportunities forecast for this decade, major appliance sales are slightly behind those of a year ago. Yet, the national economy as a whole is running ahead, he said.

Westinghouse Showing Futuristic Kitchen

Visions of what the housewife of the future will want have been cooked up by Westinghouse Electric Corp.

The manufacturer's experimental "kitchen" has cold cabinets instead of a refrigerator-freezer, solid cooking surfaces, a dishwasher that uses sound waves, and a combination electric and high-speed electronic oven.

Rather than a conventional refrigerator-freezer, the kitchen employs a series of refrigerated cabinets and drawers. They are cooled to selected temperatures by means of thermoelectricity.

The electric surface cooking platforms are made completely solid rather than with conventional cooking coils.

Other items include an ultrasonic dishwasher, thermoelectric dehumidifier, bottle cooler-warmer, and an oven controlled by a telephone dial.

The kitchen is now on tour as part of a "Parade of the Future" exhibit.

SEE Urges Uniform Heat Pump Standards

Electric heat pump manufacturers are being urged by the Southeastern Electric Exchange to adopt and comply with uniform rating standards.

A resolution citing the need for comparable heat pump ratings by the various manufacturers was adopted by the General Sales Sec-

(*Continued on page* 152)

Your Hole-Boring Equipment Lets You Install Chance Screw Anchors Almost Anywhere in 5 to 8 Man-Minutes

Your present boring equipment, regardless of type, can be adapted to power anchor installation simply by using a special Chance wrench that transmits torque from the digger directly to the hub of the anchor helix. Then, your crews are set to install anchors in 5 to 8 man-minutes . . . *from the time the equipment is moved into position until the anchor is ready for the guy.* (By adding a screw anchor adapter, the installation wrench can be attached without removing the auger bit.)

Chance Power Installed Screw Anchors go down fast, uniformly . . . anywhere that you can bore a pole hole with your power hole-digging equipment. Slow, tedious labor is eliminated. So, too, is error caused by human variables. Line construction is speeded, and you realize more on your investment in hole-boring equipment. Since the anchor rod itself is not subjected to torque, it only has to be heavy enough to support the guy load. That's a cost-saving factor, too.

Chance Screw Anchors range in size from 78 to 176 square inches in area. Their sharp cutting helixes of high-strength structural steel are tapered to minimize earth disturbance. Hundreds of installation and pull tests prove that Chance Power Installed Screw Anchors hold with less creep than any other anchors of comparable size. So, isn't it time for you to consider the advantages of mechanization of screw anchor installations?

Use Chance Power Installed Screw Anchors and get:

- Lower installation costs per anchor
- Better utilization of expensive equipment
- Greater holding power with less creep
- Consistent results
- Elimination of human variables
- Less physical effort, better employee relations

Contact your Chance Representative. He'll show you how you can apply this new anchoring technique to save time, cut costs, and improve your anchoring.

ABC INDUSTRIES

A. B. CHANCE COMPANY

CENTRALIA, MISSOURI (A. B. Chance Company of Canada, Ltd., Toronto)

CA60-31

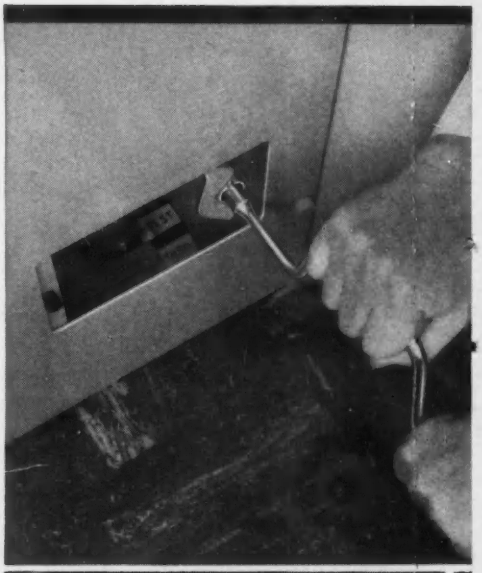
NEW COMPACTNESS

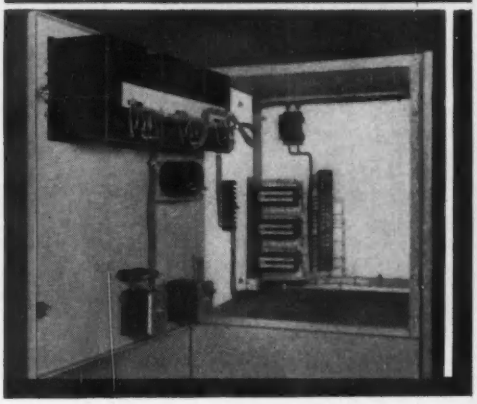
NEW SAFETY

NEW EASE OF ACCESS

NEW STORED ENERGY

This is the all-new I-T-E type HK metal-clad switchgear



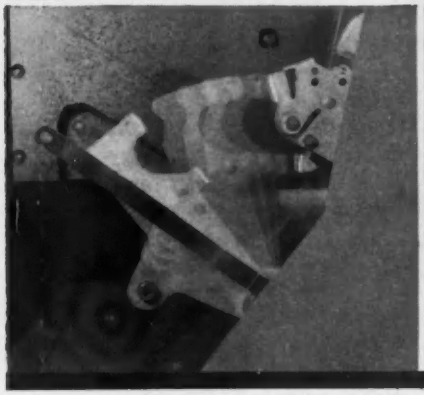


Roomy interior for easy access. Only I-T-E gives you a separate 30-in.-high instrument compartment, completely isolated from the high-voltage compartment. And it's closer to the floor, so you can reach into it easily. Put your elbows in and work in comfort. High visibility white interiors simplify installation and trouble shooting. Your control wiring can easily enter from the bottom or through the top sheet.

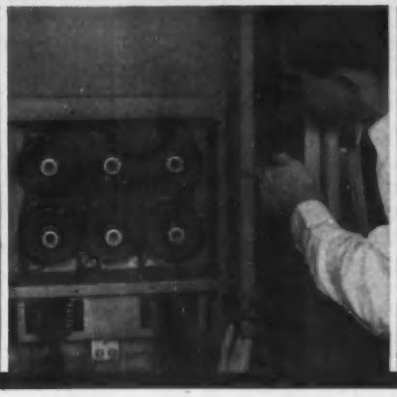
Free detailed bulletin—new strip film. Get the whole story about *all* the new advances in this I-T-E metal-clad switchgear. Learn about its easier operation, greater safety, and superior protection. Send for Bulletin 2801-2A. And ask also to see the new sound strip film. Can be shown to you singly or to your group. Contact your nearby I-T-E sales office or write I-T-E Circuit Breaker Company, Dept. SW, 1900 Hamilton St., Philadelphia 30, Pa.

Fits where others won't. This is a 4160 volt switchboard. See how low and shallow it is compared with old standards. It's only 80 in. high and 58 in. deep. So it saves both floor space and overhead space. Goes easily under low ceilings. Fits in narrower aisles. And its reduced height puts all instruments at easy-to-read eye level. Roomy cable compartments at the rear are accessible through hinged doors. All insulation in the switchboard and circuit breakers is flame-retardant and track-resistant.

Closed-door drawout. The door stays closed while the breaker is moved from connected . . . through test position . . . to disconnected and back. There's always solid steel at ground potential between the operator and the live parts of the gear. Even an inexperienced man is completely safe. Since doors stay closed, aisles need never be cluttered. And foreign matter can't get into breaker compartments.



Stored energy closing. This is not simply a new feature added to an old design. It is integrated into a completely new circuit breaker design. Gives you fast, uniform closing every time. Prolongs contact life. And you can close the circuit breakers even without control power. For greater economy, the spring charging motor draws only one-tenth the current of previous methods.

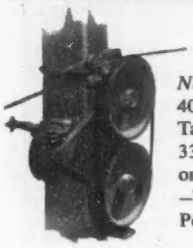


Easy-to-change current transformers. They're accessible from the front. You don't need to disturb your cable connections at all. Just remove the shutter barrier assembly over the primary studs, and there they are. As this view shows, you can locate current transformers on both load and line sides of the circuit breaker, providing more flexibility in relaying.

Compact 4160 volt circuit breaker. Low center of gravity permits easy, safe, one-man maintenance. High-strength, flame-retardant track-resistant moldings eliminate need for structural metal above the base frame. Provides insulation strength where needed most. Arc chutes tilt for easy inspection. Lift off without tools. Modern materials and new design result in substantial reduction in circuit breaker size.

I-T-E CIRCUIT BREAKER COMPANY

NEW PENGO POLE-MOUNT TENSIONER



Now...PENGO 4000 Tensioner Takes Conductor to 336,500 cm-ACSR or 397,500 cm-AAC —Tensions to 1,000 Pounds!

Here's a bullwheel tensioner you can carry in every line truck! It features two 18 inch neoprene lined bullwheels. Tru-Stop disc brake – yet weighs so little it's truly portable.

Two men can easily place the 4000 PM against the pole, attach it (chains and wing-nut tightener are permanently attached to tensioner), and start stringing in a matter of minutes. Conductor can be payed off any suitable reel stand. A collapsible reel attached to a winch shaft makes a practical puller, although any type of power previously used for pulling can be used.

TENSION WIRE STRINGING is the safe, economical modern way to string distribution and transmission lines. Why not get the facts? Write for new PENGO catalog TSE-1 for full data on the world's largest, most complete line of tension stringing equipment. Please address Dept. 124.

PETERSEN ENGINEERING CO., INC.
460 Kifer Road
Santa Clara, California
Phone: AXminster 6-7712

B-15

(*Continued from page* 148)

tion of SEE at a special meeting recently.

The action was taken at the recommendation of the SEE Heat Pump Task Force Committee which previously had conferred with representatives of several manufacturers on heat pump sales and service problems.

The resolution asked manufacturers to support the efforts of the American Refrigeration Institute in "the early development of standards for the package central system heat pump and compliance with such standards as a means of uniformity of the manufacturers' rating methods and performance. We believe this is necessary to the rapid and orderly development, use and acceptance of the electric heat pump in the Southeast," the resolution said.

GE Introduces Brighter Electroluminescent Panels

An electroluminescent light source, comparable in thickness and flexibility to a heavy magazine cover, and claimed to be five times brighter than any other now commercially available, has been developed by General Electric Co.

Available in four colors—green, blue, yellow, and white—the panels come in sizes ranging from one sq in. to 164 sq in. Initial brightness, operating on 60 cycle, 120 v, ranges from 4.5 footlamberts for green, 1.5 for yellow and white, to approximately one for blue.

Emerson Electric Develops Contractor Heating Course

A comprehensive training course for electrical contractors and other electric heat installers has been developed by Emerson Electric.

Emerson Electric distributors will sponsor the training program in cooperation with local electrical utilities.

To be introduced in October, the course is approximately three hours long and designed to be given in

(*Continued on page* 156)

BEARERS OF LIGHT... GUARDIANS OF SAFETY

with better lighting . . .

. . . Diogenes would probably have found his honest man. If you are looking for better lighting standards and honest quality, you'll find both at Daniels Standards, Inc.
Years of know-how and a new, modern production plant guarantee the best in modern street, highway, industrial, recreational lighting and traffic control equipment.

For durability, strength and beauty at a surprisingly low cost in:

- **Lighting Standards— steel or aluminum octagonal or round**
- **Strain Poles**
- **Mast Arms**
- **Brackets**

don't go around in the dark . . .
Write, wire or call

TWX NV-183

Daniels Standards, Inc.

1719 WEST END AVENUE
NASHVILLE 3, TENNESSEE

NOMINAL WEIGHTS OF FINISHED WEATHER-RESISTANT WIRE AND CABLE

(Pounds per 1000 Feet)

Conductor Size AWG or Mcm	Copper & Copper Alloy Conductors				Aluminum Conductors	
	URC Type Double Braid	URC Type Triple Braid	Neoprene Type	Polyethylene Type	Neoprene Type	Polyethylene Type
Stranded						
2	246	270	248	230	105	87.4
4	155	170	163	143	73.3	53.3
6	103	115	108	91.5	51.5	35.0
Solid						
2	239	260	232	219	92.2	79.2
4	151	164	152	136	64.0	48.0
6	100	112	101	87	45.7	31.7

Sources: American Standards Association Specifications

This table shows

POLYETHYLENE covered line wire weighs less

Because it's the lightest, polyethylene-covered line wire is the easiest for linemen to string up . . . hardest for ice and snow loading, gale-force winds to bring down.

Polyethylene-covered line wire, depending on size and conductor, weighs from 5% to 32% less than other types. That's what the figures in the specifications tabulated above show.

This, of course, is no news to linemen who have strung all types of weatherproof line wire. They may not be able to quote pounds and percentages, but they all know you can't beat polyethylene on weight.

Linemen's Favorite Material

Light weight means easy handling, one of the main reasons polyethylene rates tops with installation crews. They also like polyethylene wire because it's clean . . . free-stripping . . . has a smooth, self-lubricating surface that almost makes pulling a pleasure. And despite the exterior slip, the plastic covering hugs the conductor tightly, doesn't ruffle as it goes over crossarms.

"Built-in" Safety Factor

Polyethylene's lightness provides lasting mechanical advantages, since span loads don't tax supports as much as heavier type wire. This "built-in" weight safety factor pays off when violent storms push aerial construction to strain limits . . . when ice and snow loads topple heavier lines.

An added factor in polyethylene wire's ability to stay up under adverse conditions is its smaller diameter. It offers less resistance to wind, a smaller surface for ice build-up.

Winning Combination

Called the "closest to the ideal covering for line wire," polyethylene is outstanding in other respects too. The shield it forms over wire is continuous . . . tough . . . resistant to aging, weathering, moisture, abrasion by lashing branches. It's good for decades of superior service marked by fewer outages, minimum maintenance.

When you order covered wire and cable, make sure the coating is made with PETROTHENE® polyethylene resins. PETROTHENE polyethylene costs no more, but it gives you premium weather and stress-crack resistance.

Polyethylene's advantages are outlined in an informative new U.S.I. data sheet, "Polyethylene . . . The Best Line Wire Covering." Also available is a data sheet showing properties, applications and specifications of PETROTHENE polyethylene compounds. Send for your copies today.

U. S. Industrial Chemicals Co.
Division of National Distillers and Chemical Corp.
99 Park Ave., New York 16, N. Y.

Please send me:
- ☐ "Polyethylene . . . The Best Line Wire Covering"
- ☐ "PETROTHENE Resins for the Wire and Cable Industry"

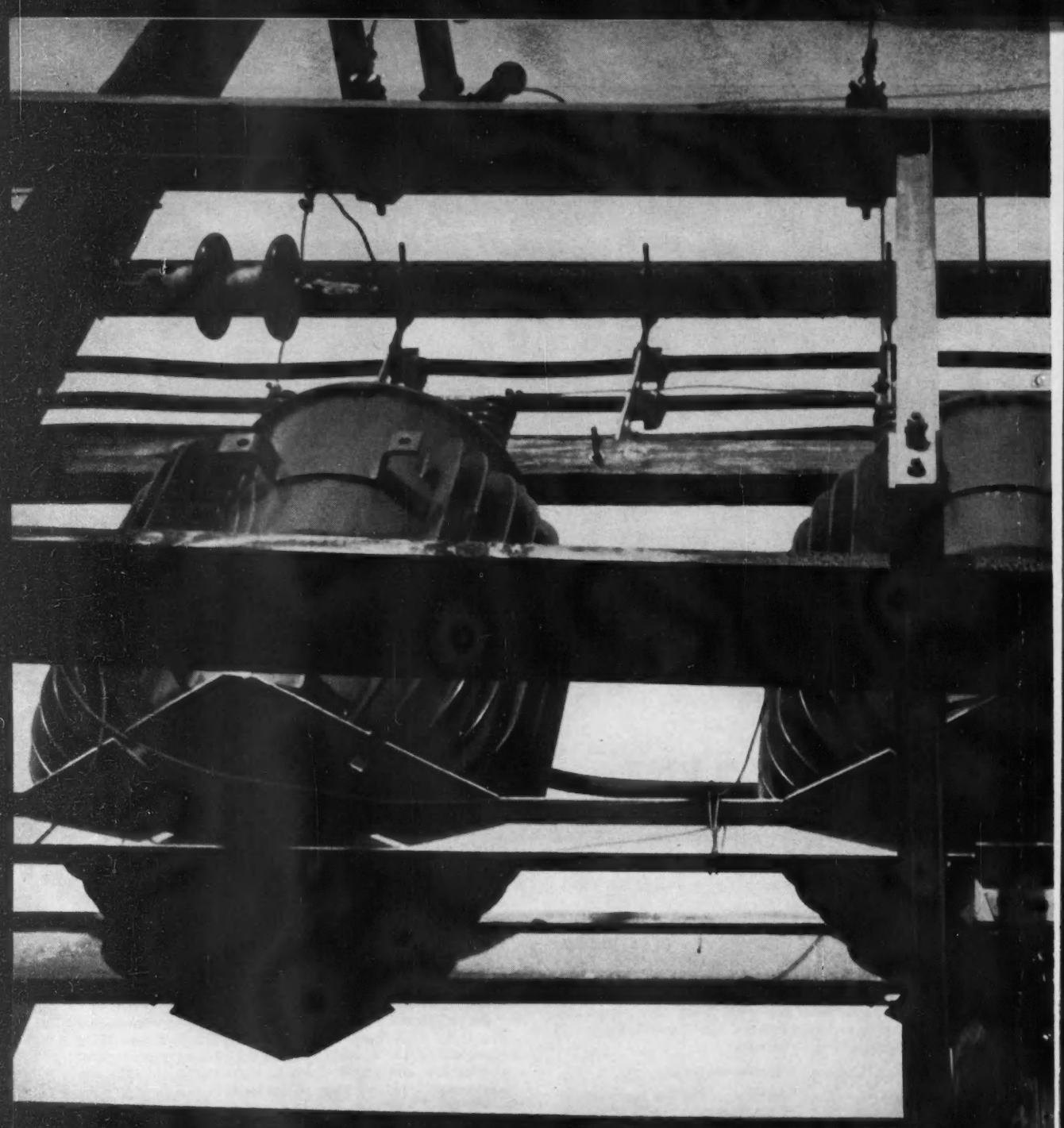
Name:_____ Title:_____

Company:_____

Address:_____

City:_____ State:_____

U.S.I. INDUSTRIAL CHEMICALS CO
Division of National Distillers and Chemical Corp.
99 Park Ave., New York, 16, N. Y.
Branches in principal cities

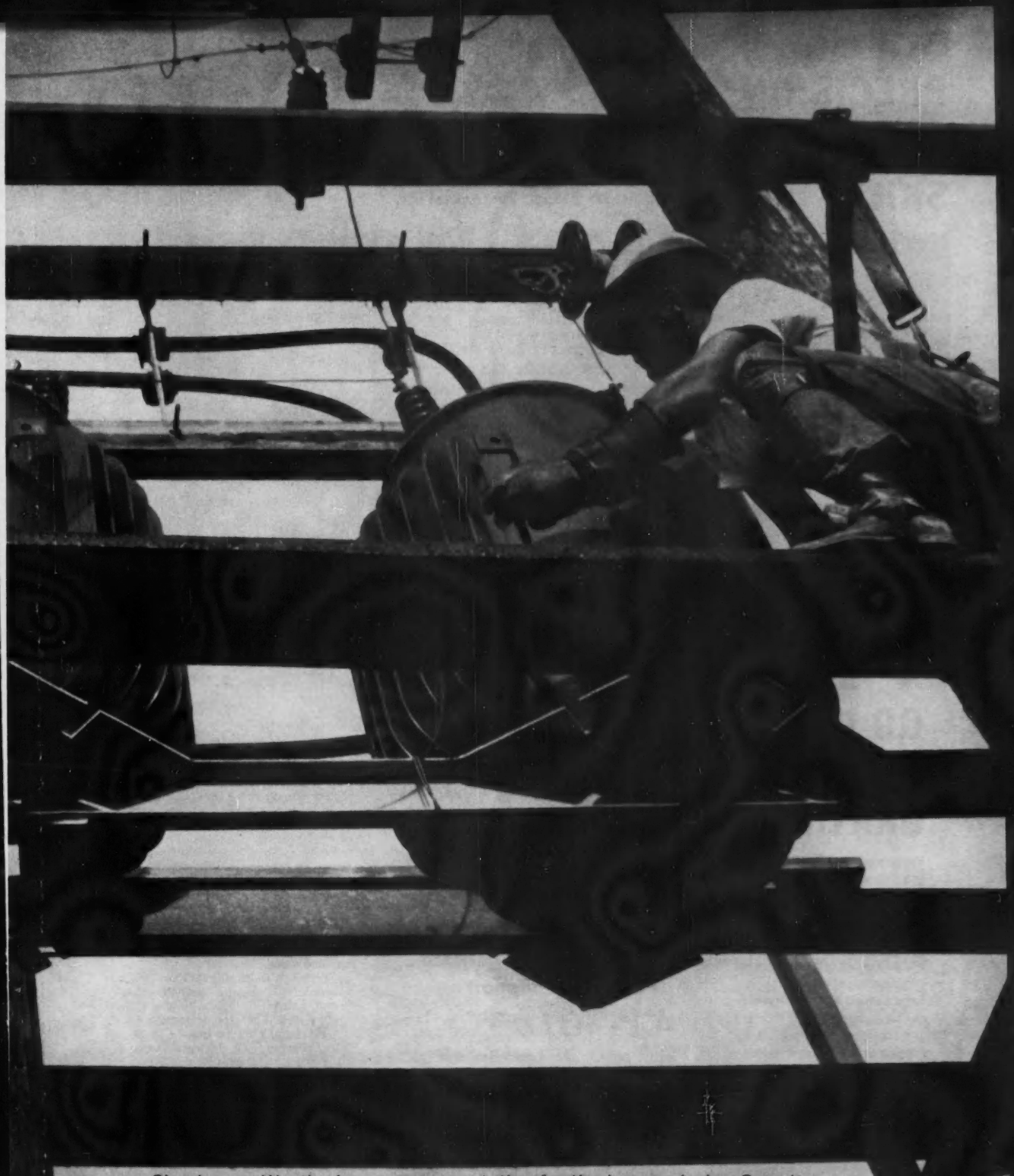


Houston utility gains 1000-kva substation capacity without substation costs

Houston Lighting & Power Company met a 333% jump in a customer's power needs with a 3⅓ increase in transformer capacity—yet no ground-type substation was required. How? This progressive utility installed 3 new-design Westinghouse 333-kva distribution transformers on a pole platform rack.

Compared to conventional substation types, advance design pole-type units—rated 250, 333 and 500 kva—chop weight by 800-980-1000 pounds, height by as much as 22%, and depth by half. Can be installed on standard platform racks.

Losses slashed 17% to 25%; lower impedance means lower operating costs.



Check your Westinghouse representative for the how and why. Or write Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pennsylvania. You can be sure . . . if it's Westinghouse.

J-70950-R

Westinghouse

PRECISION AND SKILL

★

Close-up view of an IRVICO pressure-locked aluminum grating carefully engineered to fit precisely around pipes and valves in a modern water-pumping station.

★

★

GO INTO A GOOD GRATING

When you specify IRVICO grating, you receive the benefit of engineering and manufacturing skill developed during more than 57 years of experience in the production of grating. Each IRVICO order is given careful engineering attention. Experienced shop craftsmen execute your order with finesse, and our inspectors permit no grating to be shipped unless it meets your specifications and our high standards. This insures high quality grating, an excellent fit, and no extra installation costs. Catalog on request

IRVICO

IRVING SUBWAY GRATING CO., Inc.

Originators of The Grating Industry Est. 1902

Offices and Plants at:

5067 27th St., LONG ISLAND CITY 1, N. Y.

1867 10th St., OAKLAND 20, CALIFORNIA

(*Continued from page* 152)

one session. The material consists of a 48-page training manual with supplements, 43 flip charts, and several demonstrations. The course will be presented by the regional Emerson Electric heat specialists.

Westinghouse Lamp Has Higher Efficiency

A fluorescent lamp designed for "the most light for the money" has been developed by Westinghouse Electric Corp.

The lamp, which reportedly produces 15% more light than standard 40-w cool-white lamps, and 36% more than daylight type, produces 3,200 lumens.

Excellent light maintenance characteristics are also claimed for the new bulb.

According to Charles E. Erb, general manager of Westinghouse's large lamp department, the higher efficiency is the result of a new phosphor combination. He said company scientists have compounded special green phosphors. They are delicately balanced by color improving phosphors rich in red to provide an eight shade of white fluorescent light, he said.

In another lighting development, Westinghouse has come up with a new packaging concept involving a different color on bulb packs for each wattage.

LBE's 'Flameless' Theme Picking Up Support

Industry-wide support is being picked up for the new "flameless" theme of the Live Better Electrically campaign.

William M. Shepherd, vice president of Arkansas Power Light Co and spokesman for the LBE Program, said that several manufacturers will feature the word "flameless" and "Live Better Electrically" in national advertising and promotional material.

Also utilities are purchasing more point-of-sale material based on the "flameless" theme than any such material in the past, he said.

Crapo

GALVANIZED STEEL STRAND HAS ALL 5

1. *Strength*
2. *Workability*
3. *Ruggedness*
4. *Long Life*
5. *Economy*

When you select a size and grade of strand for a specific job you want to know that it meets every requirement of that job. You want ample strength to sustain the ultimate load—plus an adequate safety factor. You want pliability for ease of working in the field. You want ruggedness to withstand the abuse which may be encountered during and after installation. You want long, dependable life. And, you want reasonably low first cost and low maintenance costs.

For more than 50 years *Crapo* Galvanized Steel Strand has consistently demonstrated its ability to more than meet all of these requirements. Proof of its reliable performance is to be found in the case histories of overhead power and communication lines throughout the country.

Crapo Galvanized Steel Strand is fully protected against corrosion by heavy, uniform, dense coatings of commercially pure zinc tightly bonded to the individual wires. All grades and sizes are available in A, B and C weights of coating.

For details, ask our distributor or write direct!

INDIANA STEEL & WIRE COMPANY, INC.

Muncie, Indiana

You can move or store almost anything, liquid or dry anywhere on earth in lightweight fold-away new FIRESTONE FABRITANKS

Got a storage or a transport problem? For a cost cutting solution write Firestone!

FABRITANK BY Firestone

Copyright 1960, The Firestone Tire & Rubber Company

Firestone Industrial Products Co., Firestone Boulevard at 17th Street, Dept. 66-1, Noblesville 2, Indiana
The Firestone Tire & Rubber Co., Coated Fabrics Division, Dept. 66-1, 2525 Firestone Boulevard, Los Angeles 54, California

MINIMUM SPACE . . . MAXIMUM RELIABILITY . . .

MAGNETIC BOILER CONTROLS FOR CAROLINA POWER & LIGHT COMPANY

Carolina Power & Light Company's H. B. Robinson Steam Electric Generating Plant, which went into commercial operation early in 1960, at Hartsville, S.C., is the world's first public utility steam generator unit to have solid state, magnetic, boiler control systems. Combustion, feedwater, pump recirculation and steam temperature controls are all Hagan PowrMag (magnetic amplifier) systems.

Hagan controls were chosen for this 182 megawatt station for several reasons, all of them stemming from the basic considerations which guided the design of the PowrMag system—flexibility, dependability, accuracy and simplicity.

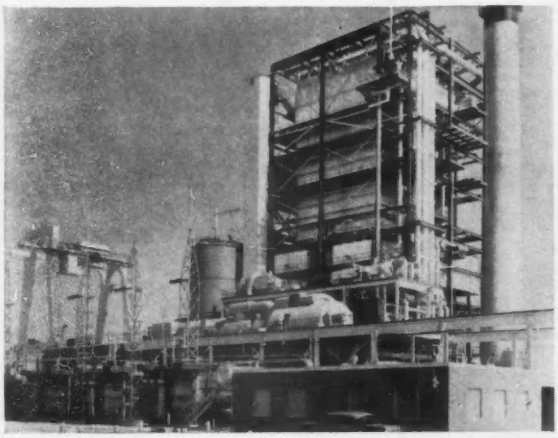
The PowrMag system utilizes dependable operational magnetic amplifiers as the basic control elements. The PowrMag controller has a plugboard into which may be inserted resistors and capacitors to provide *any* control action. This modular construction eliminates inventory problems, and provides maximum flexibility in the system. Easy to install and maintain, PowrMag systems use 1 to 9 v DC transmission and are designed to complement digital computer control.

Are you looking for controls that are dependable, do not require an electronics engineer to understand, and offer the ultimate in flexibility of application? A letter or phone call will bring you Bulletin MSP-163, which has the details on PowrMag. Or ask for a Hagan engineer to work with your own design department.

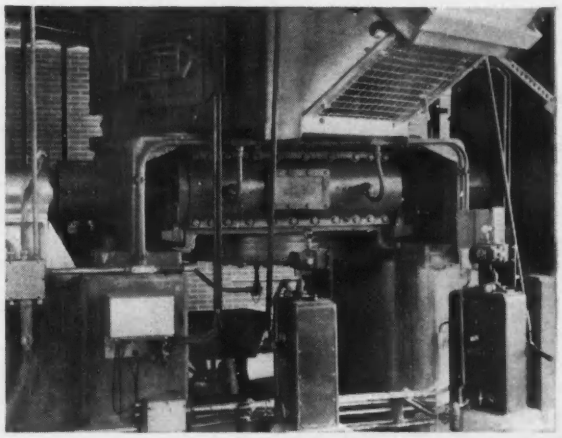
HAGAN
CHEMICALS & CONTROLS, INC.
HAGAN CENTER, PITTSBURGH 30, PENNSYLVANIA

HAGAN DIVISIONS: CALGON CO. • HALL LABORATORIES • BRUNER CORP.

An outdoor, 1,260,000 lbs/hr steam generator with divided furnace, the Robinson Plant is pulverized coal fired. Steam is supplied at 1800 psig, and 1,000F/1,000F.



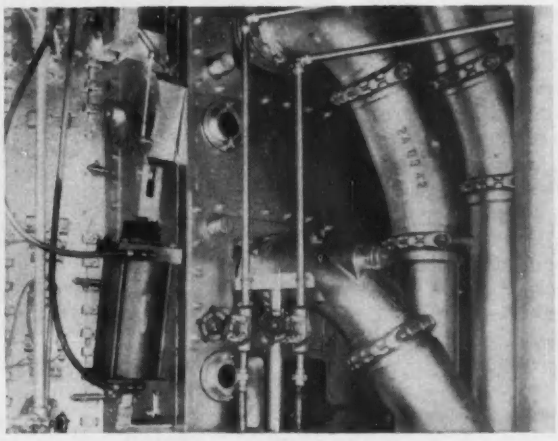
(Left) PowrMag pressure transducer, a simple transformer device without amplifier, converts mill suctions to a 1-9 v DC output. (Center) Pulverized coal mill feed positioner. (Right) Mill hot air damper positioner.



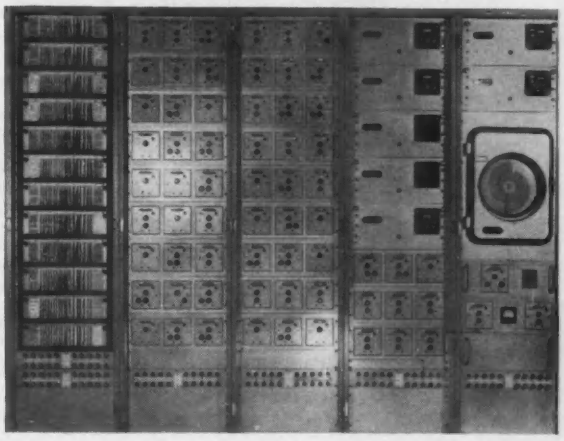
ANOTHER HAGAN FIRST...

One man controls the operation of the entire plant, including the boiler, turbine, pumps and related equipment, from this 36"-wide console. PowrMag remote control stations on the panel are miniaturized—only 2¼" x 5¼". Ebasco Services, Inc. were the consulting engineers and were responsible for the design of this compact BTG board.

Burner tilt positioner. An important part of the steam temperature control system on the Combustion Engineering Co. divided furnace unit.



Controller panel. Patchboards at left of panel permit interconnection of system. Other racks contain PowrMag controllers and PowrAmp amplifiers for various system functions; together with programmers for steam pressure and steam temperature during startup and shutdown.



News About People

ALLEN W. FOX

Fox Becomes Manager of Purchases

Allen W. Fox has been named manager of purchases for Puget Sound Power & Light Company. He succeeds Luther C. McIver who retired after a 43-year career in the electric utility field.

Fox joined Puget Sound P&L in 1929. He had been purchasing agent since 1943. He is also a past president of the Washington Purchasing Agents' Assn.

McIver was manager of purchases from 1944 until this year. He joined the utility in 1930.

Jamaica PS Names Hamill President

J. Marshall Hamill has been named president and managing director of Jamaica Public Service Co Ltd. He succeeds George W. MacDuff who retired last June because of ill health.

Hamill had been a vice president of Stone & Webster Engineering Corp. He joined Stone & Webster in 1946 and has worked on the design of many types of industrial plants both in the US and abroad.

J. MARSHALL HAMILL

Fluor Corp Re-assigns Two Top Executives

ERNEST MONCRIEF

Fluor Corp has re-assigned two of its top executives. Ernest Moncrief has been named to the newly created post of vice-president-coordinator of foreign operations and affiliates, and James P. Wiseman, former president of Fluor Products Co, will succeed him as vice president, Mid-continent Division.

Moncrief, with the company since 1937, set up the Mid-continent Division in 1948, and was named vice president of the corporation in 1952.

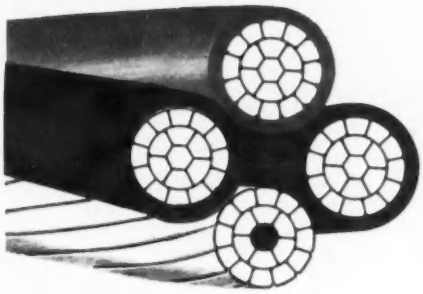
Wiseman joined Fluor in 1942, and was named vice president and director of sales in 1947.

JAMES P. WISEMAN

(*More News About People on page* 171)

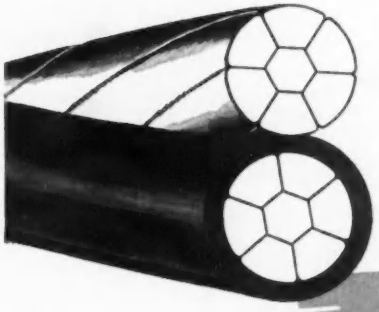
COLOR EVOLUTION

Triplex Secondaries by **SOUTHERN ELECTRICAL** Take on Lasting Color With **HYPALON®***



COLOR-CODED CABLES Insulated With HYPALON® Have These Major Advantages:

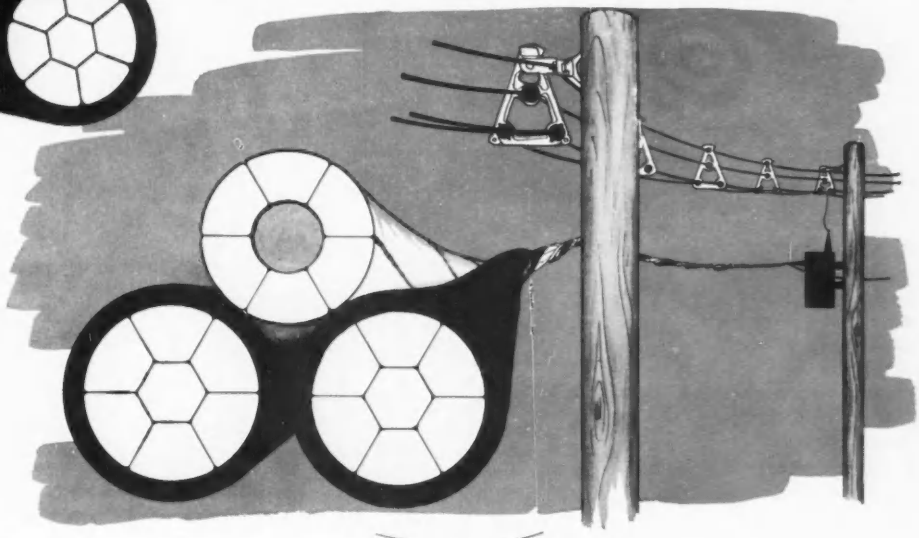
- Positive phase identification, permitting load balancing;
- Available in black, electrical red and electrical grey;
- Outstanding resistance to ozone;
- Excellent resistance to heat, chemicals, flame;
- Improved resistance to compression cutting when used on COMPRESTO®;
- HYPALON® can be stripped freely at field temperatures;
- Electrical properties of HYPALON® permit its being rated as a 600-volt class multiplex cable.



*Synthetic rubber covering with properties that exceed Two-Coat coverings for service drop cables.

Hypalon® is a registered trademark of E. I. du Pont de Nemours & Co., Inc.

Compresto® is a registered trademark of Southern Electrical Company.

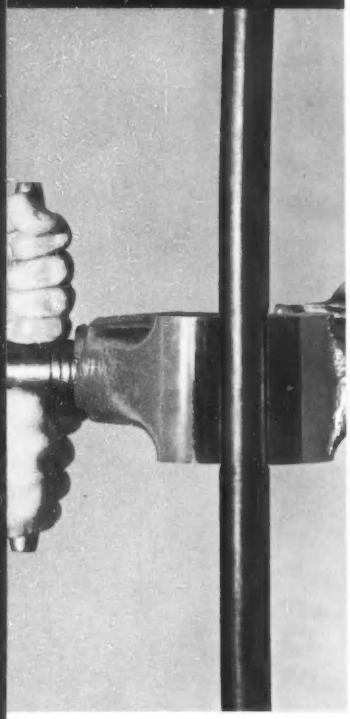


Southern Electrical Company

OLIN MATHIESON • METALS DIVISION • CHATTANOOGA, TENNESSEE

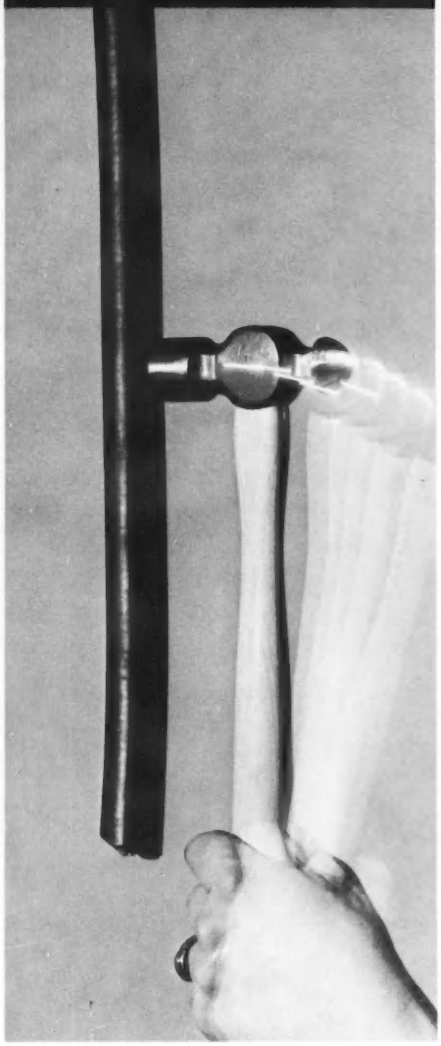
OLIN ALUMINUM

Neoprene resists COLD FLOW



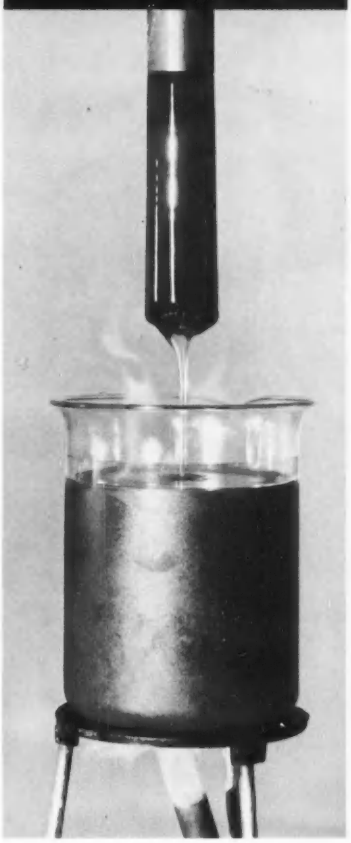
In laboratory tests and on the job, neoprene synthetic rubber has proved its ability to resist permanent deformation under load. It stays tough, resilient at high and low temperatures. Other cable jacketing materials get brittle when cold, soften when heated, flow when compressed. Not neoprene.

Neoprene resists IMPACT



Neoprene is a tough, resilient jacketing that can take impact and abuse. In the most severe mining service it has proved its ability to withstand abrasion . . . to resist gouging and tearing. It surpasses other cable jacketing materials in laboratory impact tests. It gives your cable the best protection available against abuse.

Neoprene resists HEAT . . . OIL



Neoprene jacketing resists exposure to oil, grease and a variety of chemicals and solvents. Its resistance to heat protects insulation at temperatures as high as 250° F. In addition, neoprene is flame resistant; it will not support combustion, an important factor among safety-conscious cable users in factories, refineries and mines.

Neoprene resists

SUNLIGHT...WEATHER

Installed January 6, 1935, these two test lengths of electrical cable have been exposed out of doors to rain, snow, sun, ozone and industrial fumes for over a quarter century. One jacketed with ordinary rubber (right) is badly cracked, furrowed, embrittled. But the neoprene jacket (left) is still sound, tough, resilient—still able to give complete protection to the cable.

Neoprene resists

SUB-ZERO COLD

In the arctic, neoprene synthetic rubber is used to protect radar domes—and you can use this cold weather durability in cable that must serve outdoors in frigid winter weather. Neoprene jacketing stays flexible and resilient at low temperatures ... successfully meets specifications for military cable designed for use at –65° F.

PROVED

IN A QUARTER CENTURY OF INDUSTRIAL SERVICE —THERE'S NO DOUBT ABOUT NEOPRENE JACKETING

For more information, write to: E. I. du Pont de Nemours & Co. (Inc.), Elastomer Chemicals Dept. EW-9, Wilmington 98, Delaware.

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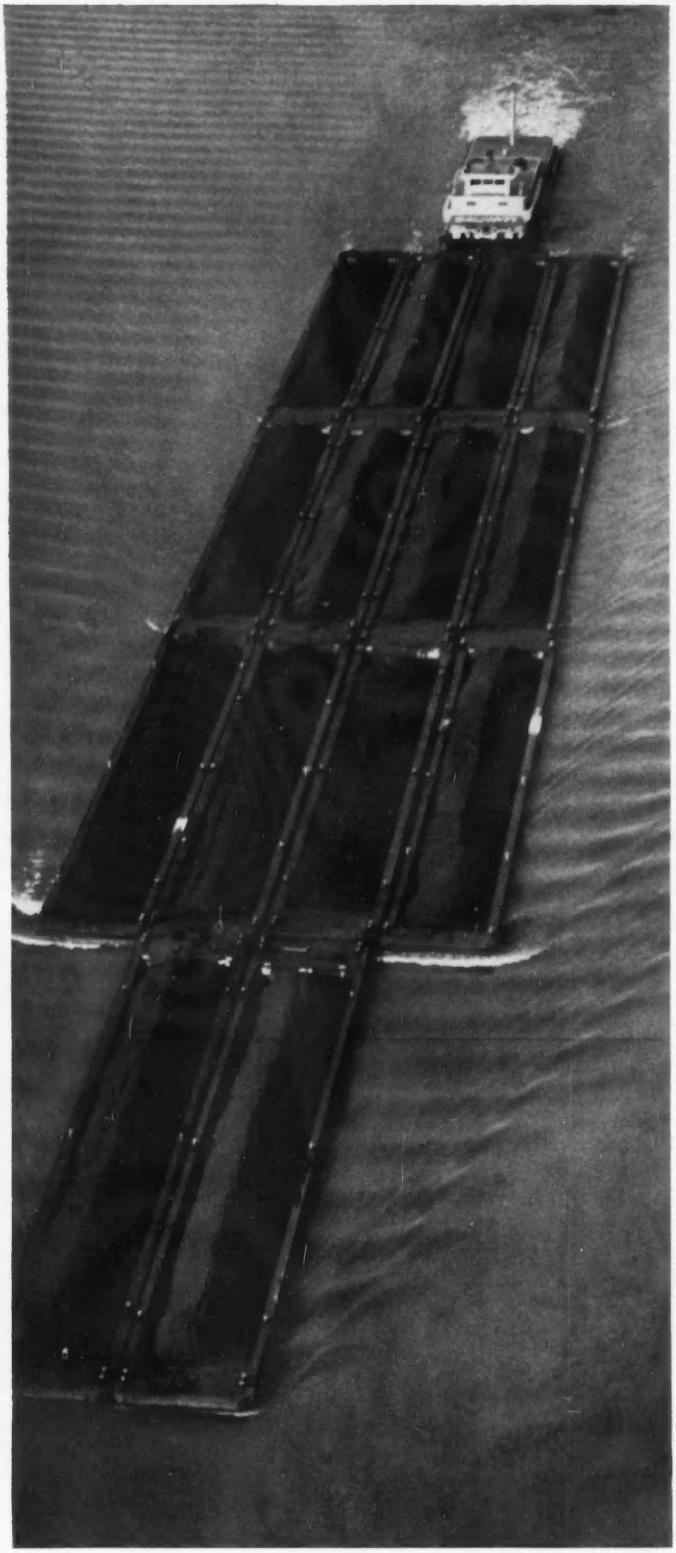
NEOPRENE
SYNTHETIC RUBBER

Better Things for Better Living . . . *through Chemistry*

how does 1970 look... from here?

(and how about 1980?)



The most look-ahead industry in the nation is undoubtedly the electric utilities. Glance back over the past 10 years and the reason is obvious. And with even greater electric needs forecast for the next 10 and 20 years, it's not surprising that any remaining short-term thinking about the way to buy *coal* is giving way rapidly to the same *long look ahead.*

There is increasing awareness that behind an attractive invoice price can be the hidden incremental costs of excessive coal handling, ash handling, equipment outages, freight charges on inerts, operating inefficiencies of many kinds.

There is increasing interest in quality coal that delivers *steam* at the lowest net cost. There is increasing interest in adequate reserves, in uniformity of supply, in suppliers in a position to deliver the right kind of coal on a reassuring long-term contract basis.

An increasing number of utilities are looking to Island Creek as a supplier of such coal . . . and such reassurance. We'd welcome a chance to discuss this matter more specifically with you. Write, wire or phone.

You can depend on Island Creek . . . a career company dedicated to coal

ISLAND CREEK Precisioneered Coals

ISLAND CREEK COAL SALES COMPANY, Chafin Building, Huntington 18, West Virginia • Chicago • Cincinnati • Cleveland • Detroit • Greensboro • New York • Pittsburgh

"And yet some manufacturers refuse to scramble for orders this way. They don't cut prices. If they cannot get business on a basis economically sound, they let somebody else take it. They reckon the prestige of their product to be worth more than their natural pride of volume. When they face a period of buyers' market they recognize that the only cure is limited production and they shoulder their responsibility."

EW, MAY 12, 1928

"Industry needs more intelligent buying. . . It needs frank, open recognition of the fact that what is bought must be paid for and that bids which embrace elements of engineering and of service, as well as the delivered product, cannot be compared by a mere tallying of the total cost figures."

EW, MARCH 17, 1928

"Manufacturers are anxious to get data as individuals but tremble at the idea of giving out individual and confidential information as to production, sales, and market expectations. . . Secrecy in these matters is not only a handicap to progress; it is a decidedly dangerous penalty that manufacturers inflict on themselves."

EW, JAN. 5, 1929

LAST IN A SERIES OF THREE ARTICLES

Now in 1960, the same question . . .

What Can Buyers, Suppliers Do?

The ability of electrical manufacturers to produce more generators, more turbines, more transformers, more switchgear, more insulators, and more of several other lines of equipment than their utility customers can use or economically carry in inventory is the single prime cause of the chaos in today's electrical equipment market. The reality of overcapacity is most obvious in the heavy generating equipment market, where undulating five-year ordering cycles force manufacturers to gear for peak demand and suffer idle capacity in the off years.

Overcapacity has stalked the switchgear field. In 1958 it helped bring on a bitter price battle that ended, as some defendants now admit, only when manufacturers colluded to restrict price decline. That the villain now haunts numerous other product fields is evidenced by the depressed prices, the distressed manufacturers, and perhaps by the long list of pending antitrust indictments. There are other causes such as a manufacturer fighting to retain a traditional share of the market or, the effort of another to take on a new customer, but the prime cause of today's chaotic market is overcapacity.

Aggravating the problem of overcapacity is the "intrusion" of foreign manufacturers into the US electrical equipment marketplace. Aided by lower labor costs and motivated by the desire to overcome their own overcapacity problems, European and Japanese firms have been able to land a few sales here. US manufacturers have also eyed overseas markets as one possible way of alleviating the excess capacity problem. Because of relatively high labor costs, the export markets are presently limited. Additional efforts could be made to exploit them.

In the "modified free economy" described in the first article of this series, and more specifically in the current electrical equipment marketplace described in the second article in this series, there is no quick, sure way to cure the problem of overcapacity. The best the manufacturers can hope for is that demand for products will catch up with productive capacity in as few years as possible.

Meanwhile, it is reasonable to expect that prices will be lower than they were when capacity and demand were more nearly balanced or when artificial restraints were practiced. Although manufacturers will not realize the profits they would like from these lower prices, they will be in a better position to compete against foreign firms, and perhaps, in the more distant future, they will also reap benefits in the extremely competitive world market. This of course assumes that present low prices will not hamper their research and development efforts.

What Should Utilities and Manufacturers Do?

Long range, utilities have much to gain from a constructively competitive equipment market. This we would define as a market in which there are incentives for high quality products, adequate research and development to meet utilities' future needs, and sufficient service to guide the application and maintenance of such products.

Utility executives, as full partners in the electrical industry, have a vital role to play in the establishment of such a market. This must come in the form of well-considered purchasing policies—policies that will serve the industry as well as the particular utility. Among the fundamentals of any utility purchasing policy are these:

- **The utility must have strong and dependable suppliers.**
- **Several sources of supply should be insured for every important product or piece of equipment.**
- **Technical advances in equipment should be encouraged.**
- **Efforts should be made to smooth out industry buying cycles to aid the more economic manufacture of large equipment.**
- **Utility purchasing men should be encouraged to apply value analysis wisely to every set of bids or quotations.**

The necessity of having strong and dependable suppliers as well as alternate sources of supply are basic tenets in most written purchasing policies, and are based as much on self-defense as on anything else.

The need to encourage a continuing program of research and development through purchasing policy applies fully to the electric utility. Historically, equipment manufacturers have borne most of the expense (including it in their prices) and provided the effort for basic technical advances in equipment. In many cases, manufacturers have also contributed to the evaluation and promotion of economic application of advances such as distribution networks and unit substations.

By making use of industry statistics at hand, utilities could help smooth out the ordering cycles for boilers, turbines, generators, and large power transformers and thereby affect some manufacturing economies. Charles E. Oakes, Chairman, Pennsylvania Power & Light Co, expressed this thought at the Edison Electric Institute Convention in June: "It is my belief that it would be advantageous to both the manufacturers and utilities if the two got together and scheduled the new units to be installed in such a manner that the manufacturing facilities would have a uniform rate of production."

The wise application of value analysis, giving consideration to product quality, manufacturer's service, delivery time, and the many other aspects of quotation, is the only fair way to arrive at the best price. No utility should expect less than the best value for its money. No supplier should ask for more money than the value of his product.

Utility purchasing agents, manning the front lines of contact with manufacturers' salesmen, also carry a key responsibility for helping to establish a constructively competitive equipment market. It is noteworthy that utility purchasing agents have not been the whipping boys of suppliers as they have in similar chaotic market situations in the past. While there have been some reports of auctioning off of bids, our information is that this has been restricted to small segments of the utility industry.

Through the wise application of value analysis and with a thorough knowledge of market figures, the utility purchasing agent is in a position to bring a measure of order to the price shambles of today's market. The buyer in today's market has been likened to the tourist in a Mid-East bazaar. No matter what price he pays for an article from the bargain-studded counters, he is reasonably sure that somebody else has bought a similar article for a cheaper price.

The utility purchasing agent is not the casual tourist who wanders into a bazaar for gift buying. He is a professional man bent on wisely serving the interests of his company. He must look to the long-range interests of that company. He owes it to himself, his company, and his industry to help establish marketing conditions in which he can have confidence. If this means temporarily penalizing some manufacturers, then he may have to do that. If it occasionally means ferreting out the cost of producing a product, he may have to do that. But one of his basic aims should be to help create a market in which he can have confidence that he is receiving fair value for dollars spent.

Of course, the main responsibility for restoring confidence to the market and stability to the manufacturing field rests squarely with the manufacturer. It is up to him to put his house in order. Help from his customer will come only as he exercises the self-discipline and the statesmanship that win confidence. Among the courses which manufacturers should consider are these:

- **Exert more self-discipline in the expansion of production facilities.**
- **Offer the utilities some incentive for smoothing out cyclical buying curves.**
- **Have sufficient unit cost data at hand to decide whether to sell a product at market generated prices, or stay out of the market.**
- **Allocate a fair share of R&D costs to the basic costs of a product.**
- **Make an effort to keep "published" prices near the actual selling prices.**

As pointed out in the second article of this series, the electric utility market for products is relatively inelastic. Demand at any one time is fixed and does not respond readily to low prices. At the same time, though, this fixed demand has enabled manufacturers to predict future demand more easily than in other industries. As a result, there has been and still is a tendency on the part of most manufacturers to want the same, if not a growing, share of the *assured* future market. In addition, outsiders or those not already in the field see this assured market as a standing invitation for them to get into the field. In other words, the pie is growing bigger at a known rate, and everybody wants a bigger piece of it than they have been getting.

To complicate the matter, this steadily increasing competition means steadily increasing efforts to reduce costs, either by introducing highly-automated production techniques requiring high volume, or by substituting machines for men in the more custom-built product lines. Unfortunately, both these cost reduction efforts often bring on the unwanted side effect of adding still-greater production capacity on the line.

To cope better with this recurring problem of overcapacity, manufacturers must exercise more restraint in setting their sights on their future share of the market. In the case of the larger manufacturers, this restraint will probably have to come from top, not divisional, management.

Just as important, manufacturers should, when in the process of cutting costs, try not to add more capacity than the market can bear.

Price incentives for advanced buying of heavy generating equipment is already being offered by at least one large manufacturer. This is a step toward smoothing out the cyclical buying curves. Manufacturers need to give more study to such incentives.

One reason being given for abnormally low prices being quoted on some product lines is that manufacturers sometimes don't know their production costs, even with today's cost accounting methods. Better defined production costs would help guide the price quotations and indicate to a manufacturer whether a sale is profitable or whether he would be better off without it.

Just as utilities should support R&D efforts of manufacturers, so should manufacturers try to protect such programs during hard times. It is to the long-range benefit of the customer as well as to the manufacturer that R&D costs be included in product prices.

"Published" prices should be no laughing matter to utility customers. Yet many of them have been over the years. One way to bring about a measure of confidence in "published" prices is to make sure these are as near as possible to actual selling prices.

For both the utility customers and the manufacturing sellers more marketing information is needed. Our extended study of the current situation leads us to conclude that the wider dissemination of market prices—as expressed in bids and quotations—would be helpful to both the buyers and the sellers. It would take some of the bazaar atmosphere away from today's equipment marketplace. We believe it would lead to the more equitable treatment of customers, and discourage extreme instances of price cutting.

Manufacturers should also consider the publication of additional industry figures—including the unit sales figures and production capacity of some lines of equipment. Such figures are available in the automobile industry. They are a part of the data on which expansion and sales plans are based. They would help prevent some of the shots-in-the-dark responsible for some of the distress in the electrical equipment market.

In this series of articles, we have endeavored to interpret the present electrical equipment marketing situation—setting it in a perspective that will stimulate logical, calm thinking.

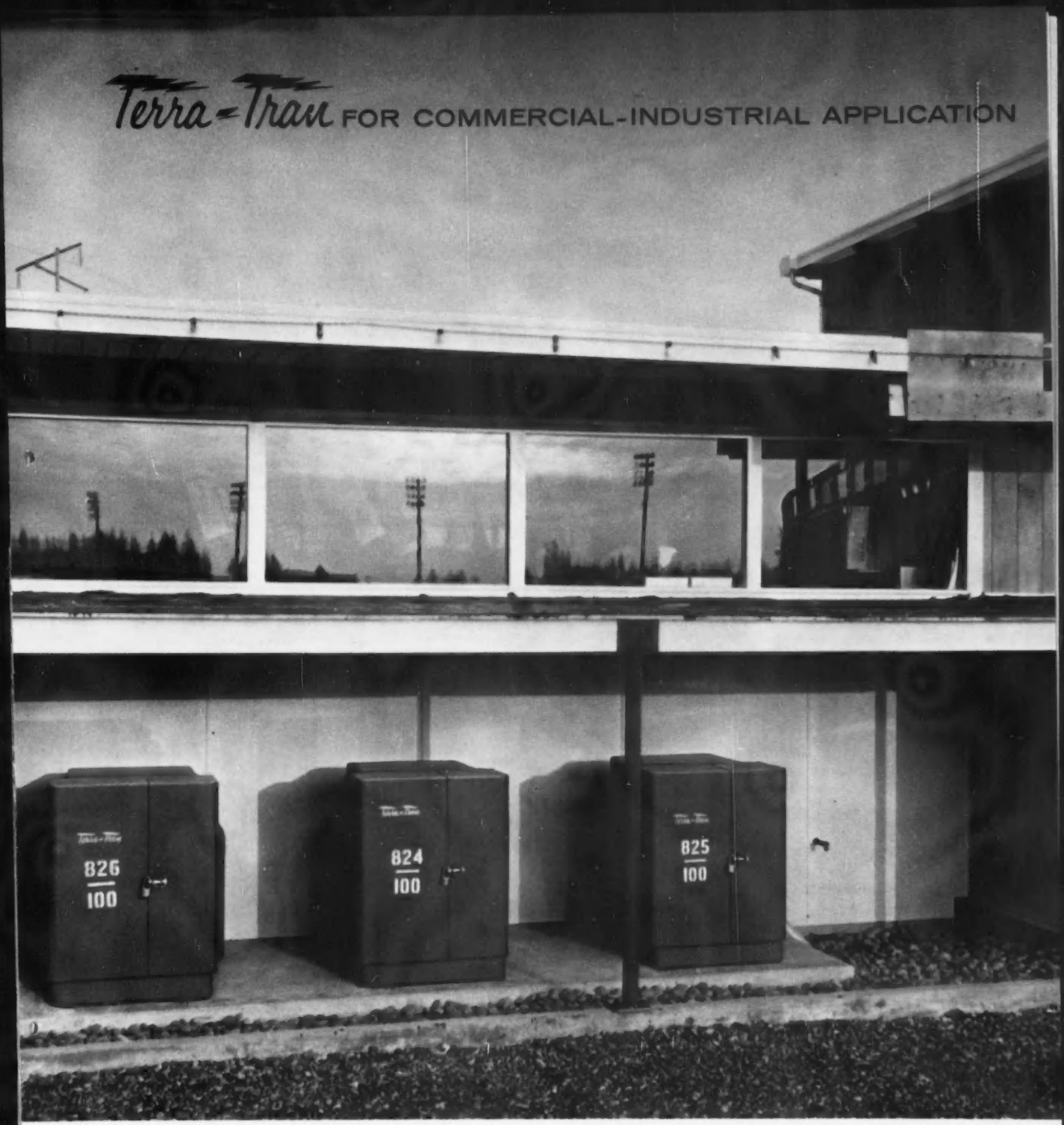
In the first article, the electrical equipment market was discussed as a part of the over-all "modified free economy" which operates in the US today.

In the second, an attempt was made to describe the development and the present status of the electrical equipment market.

In this concluding article, we have offered a few tentative suggestions to both utilities and manufacturers for creating constructively competitive market conditions under which both utilities and manufacturers can operate at a fair return to expand and improve their services to their customers.

In the firm belief that wider dissemination of information on the electrical equipment market will aid in putting the market on a healthier basis, Electrical World plans to expand and sharpen its reporting in this field. Beginning with the next issue, we will inaugurate a new department on our up-front yellow pages geared to bring you late developments and informed interpretation of events in the overall electric utility procurement field.

Terra-Tran FOR COMMERCIAL-INDUSTRIAL APPLICATION



Terra-Tran provides safe, economical underground distribution for commercial-industrial users: schools, hospitals, shopping centers, airports, and industrial parks.

With Terra-Tran installed in these applications, utilities eliminate unsightly poles, platforms, and guy wires, keeping architecture, landscapes, and parking lots free and clear from distractions and hazards. Terra-Tran provides the dependable service necessary to commercial-industrial users, reducing emergency service interruptions by as much as 75%. Terra-Tran is completely safe. All high voltage parts are completely enclosed in a tamper-proof cabinet; high voltage wires are buried, eliminating overhead risks.

New installation techniques have greatly reduced the cost of bringing electrical distribution down to earth. Utilities can now Terra-Tran commercial-industrial sites at costs comparable to heavy multi pole platform installations.

Terra-Tran — pioneered and developed by RT&E — is available in a wide range of ratings . . . Single phase from 15 KVA to 167 KVA; three phase from 75 KVA to 300 KVA.

Write for Bulletin 300 for detailed information on safe and economical methods to Terra-Tran your next commercial or industrial development.

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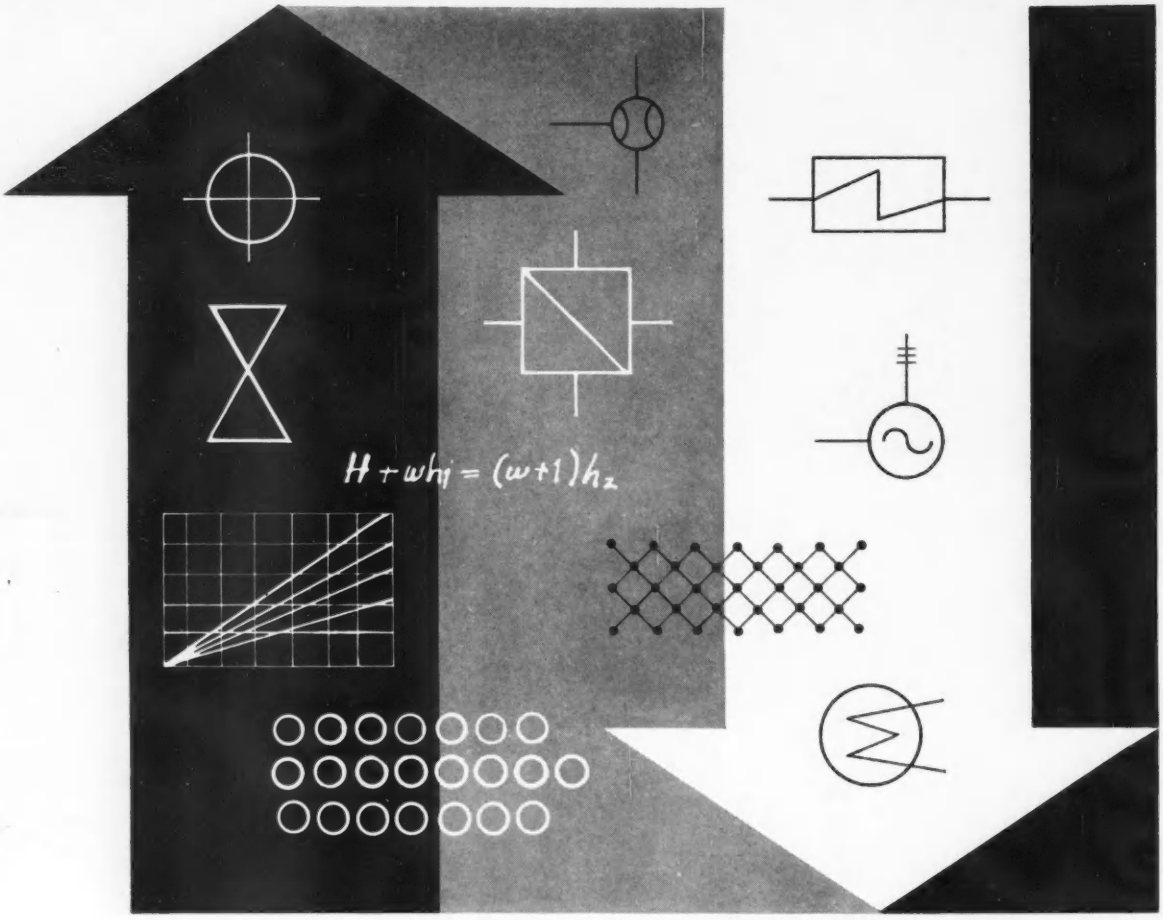


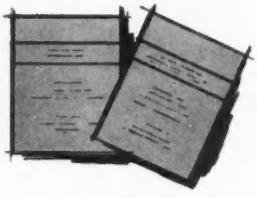
CONTINUING LEADERSHIP IN VITAL RESEARCH

What happens during the start-up and shut-down operations of power plant condensers? Do you know what sources of oxygen contamination exist in the cycle? How can the oxygen in a proposed installation be eliminated without special and costly equipment?

These are but a few of the questions answered in the free 16-page report entitled "Trends in the Design of Deaerating Condensers" published by the Research and Development Division of C. H. Wheeler.

C. H. Wheeler research has led to the ultimate in the design of deaerating condensers and we are constantly looking for better materials and designs for auxiliary power plant equipment.

For example, extensive testing is now being done on journal and bearing materials to improve performance and life of condenser circulating water pumps. Results of tests conducted to date are reported in the booklet "Performance Tests of Water Lubricated Bearing Materials for Circulating Water Pumps."



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KAESEMEYER

DOUGLASS

Fuller Co Names Two Vice Presidents

Fuller Co has named C. C. Kaesemeyer executive vice president, and Donald S. Douglass, vice president-division sales coordination. Jack L. Prather has been made assistant to the president.

Kaesemeyer was formerly general sales manager. He has served in the company's engineering, service and sales departments. Between 1946 and 1951 he was manager of the Midwest Division.

Douglass served as assistant general sales manager for the past two years. Before that he was general manager of the Fuller affiliate, Separation Process Co.

PERSONAL BRIEFS

Charles R. Day has become chief electrical engineer for Sacramento Municipal Utility District, in charge of the engineering department.

The following promotions have been made at West Penn Power Co: **John F. McQuillin,** assistant to the vice president — marketing; and **Donald T. Faust,** Eastern Division manager.

Public Service Electric & Gas Co has made the following appointments at its Mercer Generating Station: **William E. Karg,** superintendent; **Edward C. James,** chief engineer; **Herbert J. Heller,** master mechanic; **Thomas L. Wilson,** station performance engineer; **Kurt Brenner,** operating engineer; **Raymond F. Peeney,** start-up engineer; and **Cecil Thompson,** chief clerk for Mercer and Burlington Generating Stations. At Burlington Generating Station: **Elliot A. Hussey,** superintendent; **John M. Steinsieck,** chief engineer; and **Joseph A. Fischer,** station performance engineer. At Sewaren Generating Station: **John E. Billings,** chief engineer; and **Herbert S. Arnold Jr,** station performance engineer. At Kearny Generating Station: **Alan D. Weiss,** boiler room engineer; and **Robert F. Dittrich,** station performance engineer. At Marion Generating Station, **Robert T. Pearson,** station performance engineer. And, at the General Office, Newark, **William Irwin,** performance engineer.

Warner T. Smith was named chief engineer of Superior Cable Corp.

J. Carl Ferguson has been named director of electrical conductor marketing, and **Cornell C. Maier** succeeds him as division general sales manager in the Electrical Conductor Division of Kaiser Aluminum & Chemical Sales, Inc. Kaiser Aluminum & Chemical Sales, Inc, has transferred its New York district sales offices to 190 East Post Road, White Plains, N. Y. **Clarence W. Higbee,** assistant general manager of the Electrical Conductor Division, has retired.

(*More News About People, p* 174)

GTC

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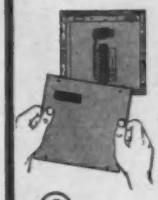
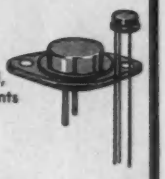
1 Highly effective in extremes of ambient noise and temperature.



2 Plug-in units provide ease of installation, expansion and maintenance.

3 Transistors and rugged, industrial type components used throughout.



4 Central control cabinet, costly engineering and fabrication eliminated.

Wherever a highly dependable, voice communication system for use in high noise level areas is needed—you'll find GAI-TRONICS specified by name.

GTC is extremely flexible in application. Write today for a copy of our completely illustrated, descriptive booklet and name of nearest representative.

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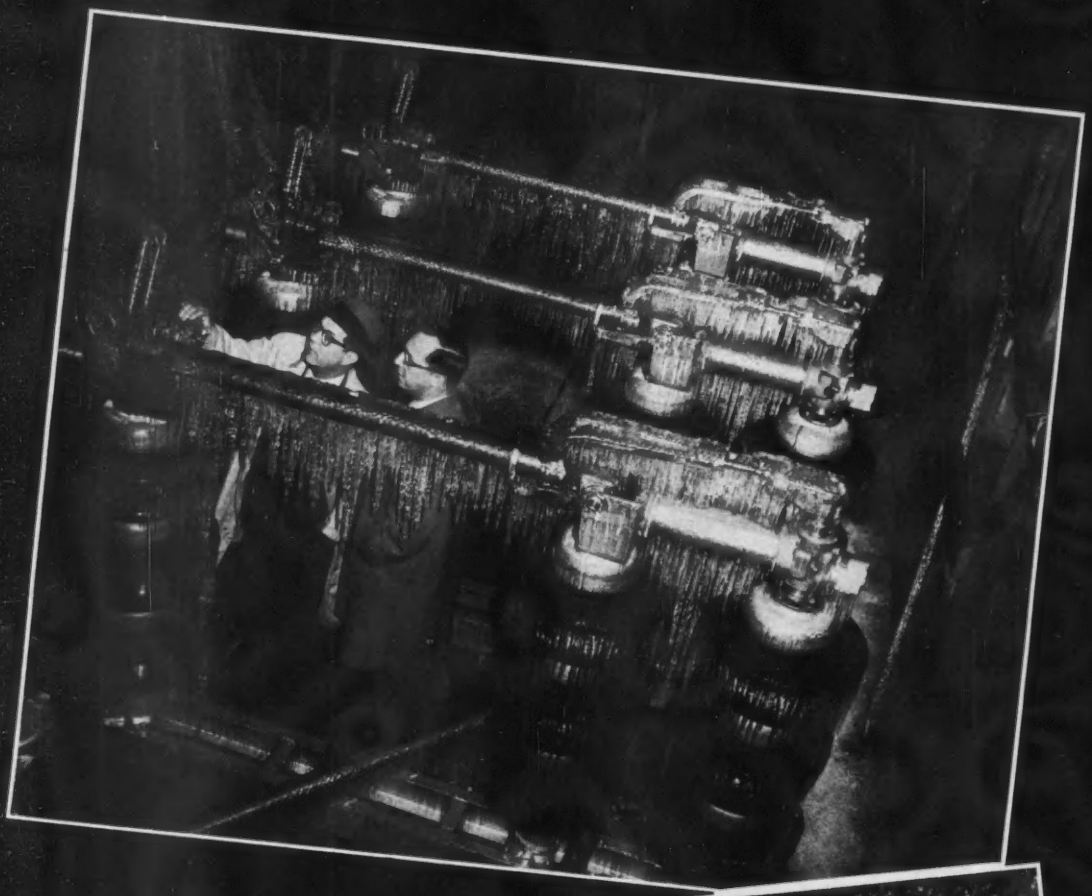
NEW WESTINGHOUSE V-2 SWITCH EASY TO OPERATE



UNDER NORMAL OR ABNORMAL CONDITIONS

The features built into the V-2 not only make year-in and year-out operation easier, but also contribute to remarkably easy operation under abnormal conditions like those duplicated at the left in our High Power Lab. This 115-kv switch complete with operating mechanism was iced first in the closed position (shown), then the open position, and operated with ease. Closeups show dramatically the thickness and transparency of the "hard ice" coating. Check these outstanding features:

TEFLON-COATED BUSHINGS on all live-side bearings assure long-life, low-friction operation. Bushings never need lubrication . . . are unaffected by corrosion. Teflon-coated ball-and-socket joint between operating lever and blade lever lowers operating effort.

ENCLOSED COUNTERBALANCING MECHANISM, riding on delrin rollers, provides proper balance for easy switch operation and can be changed in the field to accommodate mounting the switch in either the horizontal upright, vertical or underhung positions.

MOUNTING HOLES on the sides of every V-2 switch accommodate devices for simple, quick, in-field conversion to load break during, or after, switch installation.

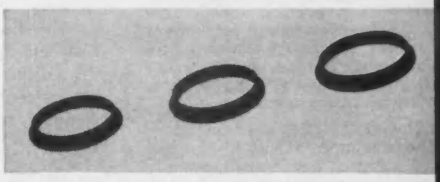
And these are not all the important features of the new V-2 switch. It retains major design elements found in the outstanding "V" switch—such as the solid current-carrying bridging member enclosed at blade hinge, yet completely inspectable . . . rotating insulator bearing recessed in base . . . universal operating lever on driven pole . . . and the ability to function positively, safely under adverse atmospheric conditions, even ice.

YOUR NEARBY WESTINGHOUSE REPRESENTATIVE has full information on the new V-2 switch. Call him . . . or write Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pennsylvania.

J-61003

YOU CAN BE **SURE**...IF IT'S **Westinghouse**

SMOOTH OPERATION of the Westinghouse V-2 switch is assured by (1) teflon-coated bushings on all live-side bearings and teflon-coated ball-and-socket joint which reduce operating friction, and by (2) counterbalancing mechanism, totally enclosed in copper tube, which provides proper blade balance in any mounting position.



MAINTENANCE IS MINIMIZED in the V-2 by noncorrosive, teflon-coated bushings. Uncoated bushing at left is badly corroded after 1000-hour salt spray test. Coated bushing (center) is unharmed. Bushing at right, even with outside teflon coating deliberately removed, is nearly perfect, protected by teflon which penetrated metal.

EASY CONVERSION TO LOAD BREAK in the field is possible with the new Westinghouse V-2 switch. These mounting holes drilled into the sides of all V-2 switches accommodate the auxiliary blade, which can be quickly added to the V-2 after it is installed.

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When it comes to locating decay symptoms, there's a world of difference between inspection methods. All OSMOSE Inspectors are permanent employees, specially trained and alert to locate hidden trouble areas which might easily escape less-experienced operators.

And the OSMOSE treatment is equally thorough. If decay is present, all infected areas are carefully chipped away, using a special, Osmose-designed tool. The remaining circumference is accurately checked to determine safe load-bearing limitations. Then, liberal quantities of OSMOPLASTIC and the extra wrap-around protection of OSMOSHIELD are applied by men who know their jobs and take pride in their work. In the past 20 years, over 5,000,000 poles received this effective, long-lasting treatment.

If you want Inspection and Treatment that leaves nothing undone to keep every older pole safe and sound on the job, for less than 5% of replacement cost, get the full facts about the Osmose method. Write: Osmose Wood Preserving Co. of America, Inc., 991 Ellicott Street, Buffalo 9, N.Y.

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SALES ASSIGNMENTS

COMPANY STAFFS

Southern States Equipment Corp has promoted Roy N. McCowen to Southwest regional manager; Bruce Smith to district manager, with offices in Dallas, Texas; Phillip Williams, Southeast regional manager, covering Florida, Kentucky, Alabama, and portions of Georgia, Louisiana, and Mississippi; John Howell, regional manager covering South Carolina, North Carolina, and portions of Georgia; Thomas Ellison, regional manager for West Virginia, Virginia, Tennessee, Pennsylvania, Delaware, Maryland, District of Columbia, and portions of Mississippi and New Jersey.

Kuhlman Electric Co has appointed Pete E. Taylor southern regional manager with headquarters at Mimosa Lake Park, Route 2, Raymond Mississippi.

Babcock & Wilcox Co's Boiler Division has named Robert V. Mourer district service engineer for the newly organized Denver sales district. He will assign and direct the service activities of B&W field engineers within the district, comprising the states of Colorado, Montana, New Mexico, Utah, and Wyoming, and certain portions of Idaho, Nebraska, Nevada, South Dakota, and Texas.

Holan Corp has named Charles S. Canfield Jr district manager in York, Pa., directing sales activities in parts of Delaware, Maryland, New Jersey, Pennsylvania and the District of Columbia.

REPRESENTATIVES

RT&E Corp has appointed Edison W. Lytle sales representative for the newly organized territory of Cleveland, Ohio, which includes parts of Ohio, West Virginia, New York and Pennsylvania. Harold L. Rush has been named sales representative in Tennessee and the upper two-thirds of Georgia. He is located in Doraville, an Atlanta, Ga., suburb.

Esco Manufacturing Co has appointed H. B. Stallings & Associates, Wallingford, Pa., representatives in the Philadelphia area.

Subox, Inc, has appointed Williams & McKinley Sales Co, sales representatives in eastern Missouri and the greater St. Louis metropolitan area. In Kansas City, western Missouri and Kansas, representative will be Williams & McKinley Sales Co, Kansas City, Missouri.

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Revised by FRANK STETKA
Electrical Field Engineer
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Here is the electrical contractor's job book completely revised to conform with the latest code requirements and planned to enable electricians to understand and do work in strict accordance with the National Electrical Code. It explains rules and measurements for electrical jobs—what they mean—how to apply them. With this handy guide you can refer to any rule quickly and easily—the book follows exactly the same number system as presented in the Code. Included in the revised Tenth Edition is the complete rearrangement and renumbering of the National Electrical Code, and numerous vital changes in basic requirements. The book enables you to grasp readily the general plan, scope, and purpose of the National Electrical Code requirements. It makes practical application of the rules clear and easy to understand. **679 pp., 387 illus. $10.00**

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President, Cooke Engineering Company
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Technical Director, Dictionary Department, McGraw-Hill Book Company, Inc.

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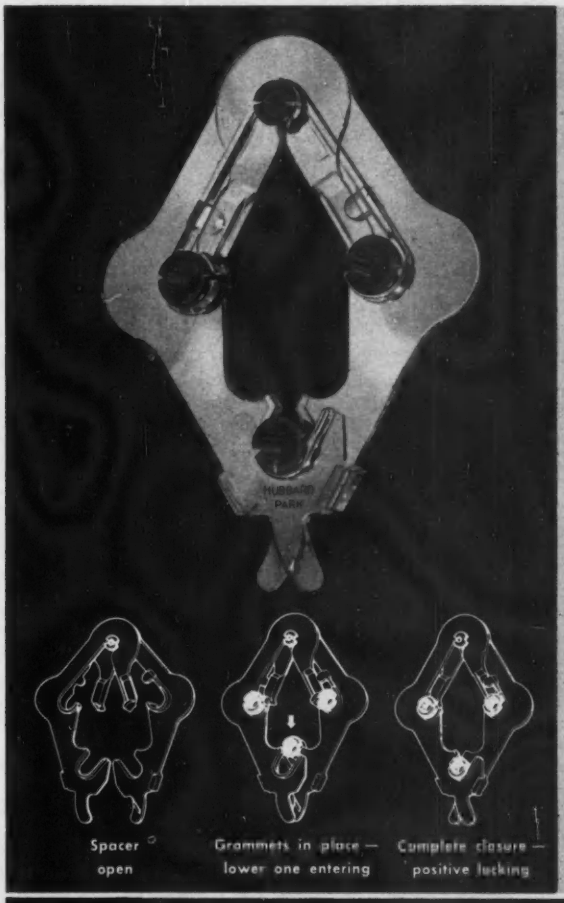

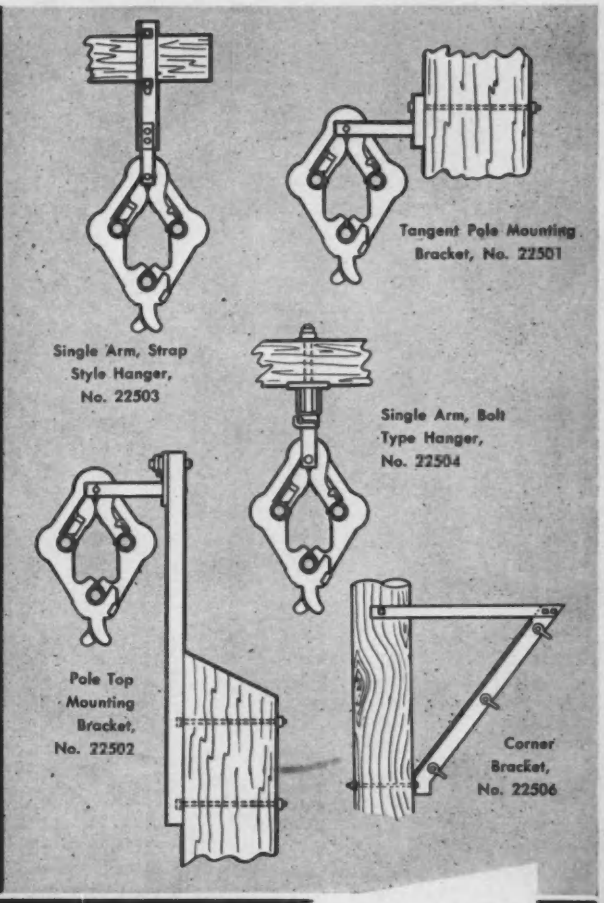
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UNOBTRUSIVE RIGHT-OF-WAY is jogged frequently and designed to preserve park's natural beauty. Small trees are left in 40-ft-wide path

Yellowstone Power Stirs Controversy

While a 69-kv transmission line unobtrusively brings power to Yellowstone National Park, Congressional hearings into the question of electric service to the park are bristling with controversy.

Montana Power Co's 100-mile line, serving the park between Canyon and Lake, began service this year. The company extended its system which had been serving Mammoth Hot Springs in the park since 1950.

The fact that it already had a line into the park counted heavily in Montana Power's favor when the government decided upon a power supplier for Yellowstone. It was felt that additional lines by other suppliers would damage park values, while service from one supplier would keep poles to a minimum.

Controversy Flares

At about the time power was beginning to be supplied to the park, controversy over the line came to the fore in Congressional hearings.

Declaring that the Interior Department acted "most prudently and in the best interests of the government" in awarding Montana Power the contract, Rep Clare E. Hoffman (R-Mich.) charged that the record of House Committee on Government Operations hearings on the subject was incomplete.

A member of the committee, Hoffman charged that the subcommittee chairman, Rep John Moss (D-Calif.), had "gagged the very man who is chief defendant in this inquisition." Hoffman was referring to Conrad L. Wirth, director of the National Park Service, who Hoffman said was barred from testifying.

The Michigan Congressman said that if one of the REA cooperatives which bid on the proposal had been granted the contract, it would have cost the government an additional $25,000 per year. The REA would have borrowed money from the government at 2% interest to build the necessary facilities although the government must pay between 4% and 5% for the money it borrows.

Hoffman pointed out that one of the competing REA proposals would have required cutting of timber and construction of a line through Bechler River valley.

It is estimated that availability of commercial power in the park will permit the government and concessionaires to close down their power generating facilities for continuous service within two years. Most of the equipment is nearly a quarter of a century old and in need of repairs. Within the past two years, $90,000 has been spent on generating equipment at Canyon alone.

new

DUAL-RATIO 600-VOLT BUTYL-MOLDED CURRENT TRANSFORMER and Secondary Conduit Box

Type JKP-0 Indoor-Outdoor Current Transformer, 300/600:5 and 400/800:5 amperes

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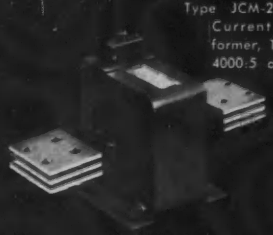
and NEW BUTYL-MOLDED BAR-TYPE 2500-VOLT CURRENT TRANSFORMER



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The new JCM-2 Transformer replaces non-butyl types in the 1200:5 to 4000:5 ampere range. Interchangeable with all ratings of the superseded JKR-2, it provides superior accuracy and burden capability. Contact your G-E apparatus salesman for more details. 714-07

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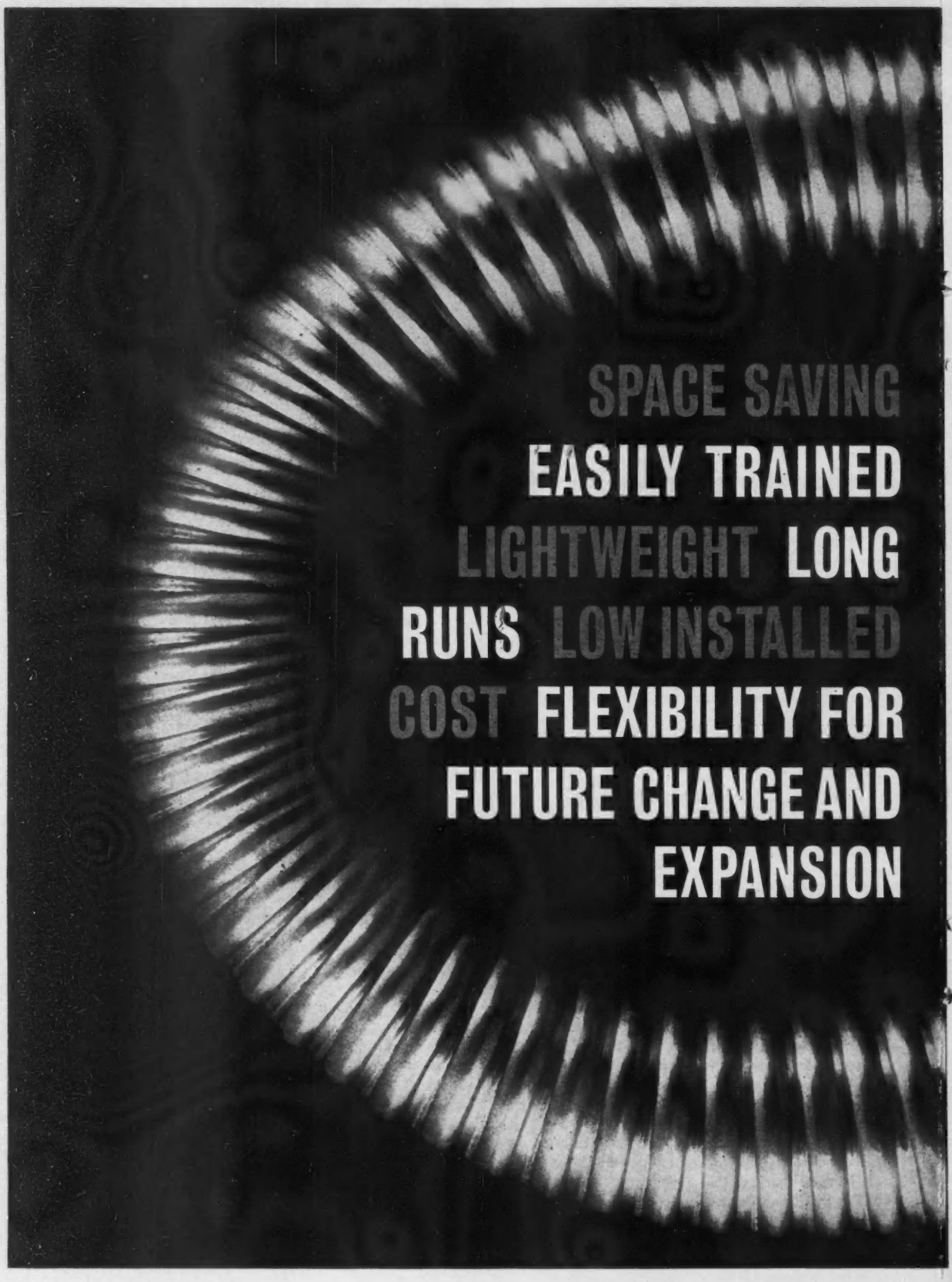
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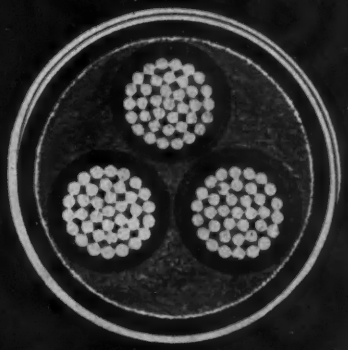

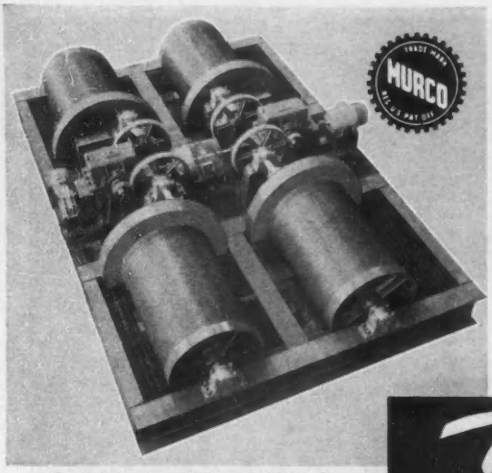

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Debris Problems at Dams To Be Studied by US Corps

The Corps of Engineers has announced plans to study floating trash disposal above the site of the Ice Harbor Dam, on the Snake River. Part of a stepped-up program to eliminate debris that causes handling problems at each of the dams on the mainstream of the Columbia, the study will be carried out by the Walla Walla district of the Corps.

At first the study will be limited to installation of some type of temporary barrier above the Ice Harbor site. Later, a boom or some other collection and disposal device might be permanently installed at Lower Granite Dam, one of the three Corps of Engineers dams authorized for construction above Ice Harbor. The devices would catch debris from both the Snake River and the Clearwater River, one of the Snake River tributaries. A conveyor belt system for removing the trash for burning is under consideration.

A Corps spokesman said that trash had also been a problem at McNary Dam, on the Columbia River, where gates on the spillway section have to be opened periodically to release debris cluttered there.

Line Construction Halts To Wait for Birds to Grow

A big power project in Licking County, Ohio, has come to a temporary halt because of interference —by a flock of half-grown birds. The birds, still too young to fly from their nests, are blue herons, standing more than four ft high, with a wingspread of six ft.

Ohio Power Co, planning a 69-kv transmission line from Granville to Etna, came upon the herons' nests when clearing the right-of-way through thick woods. More than 50 nests were spotted in the branches of a half-dozen trees within a radius of 50 yards.

Ohio Power considered the problem at length and decided to leave a one-mile stretch uncleared until the herons were old and strong enough to fly away.

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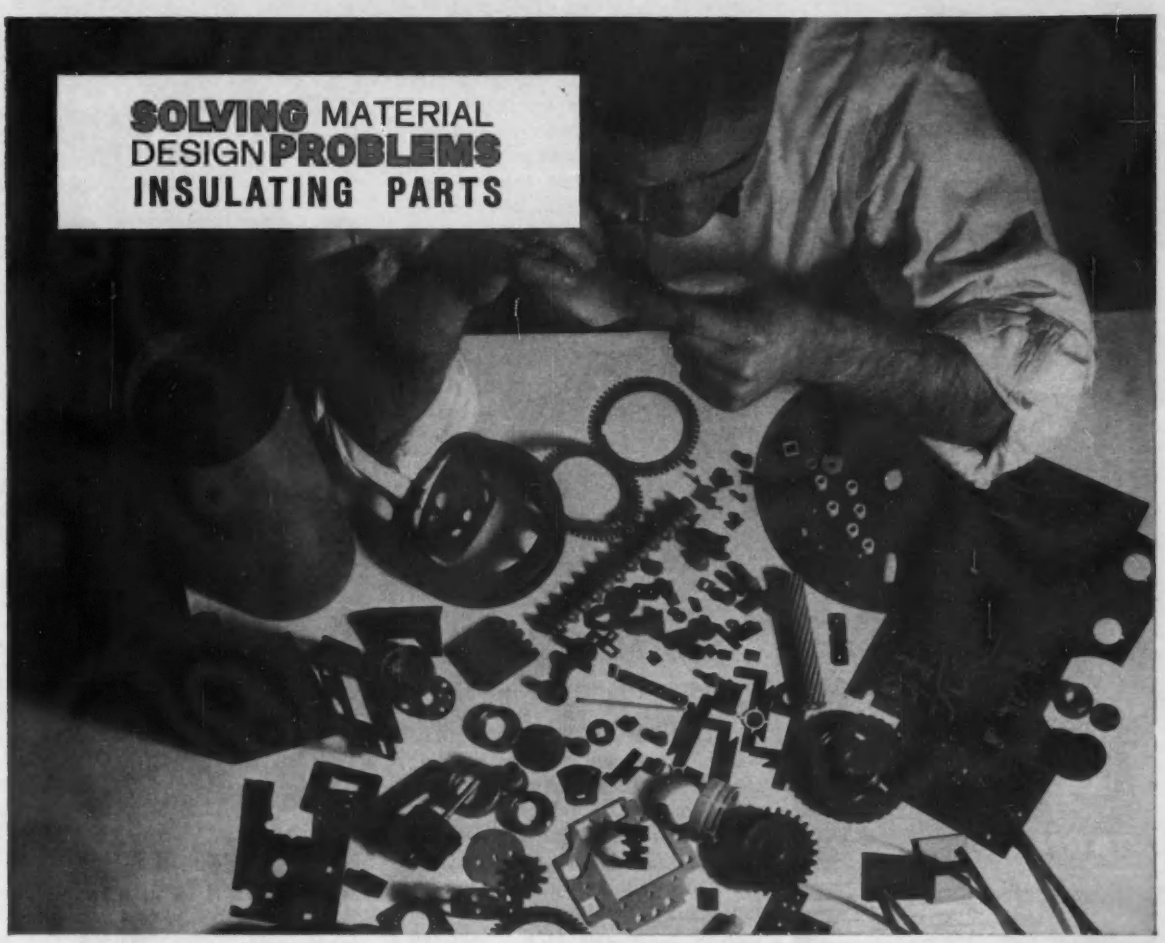

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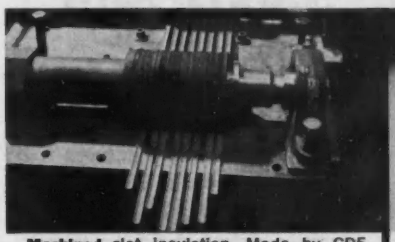

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(*Continued from page* 102)

based on symmetrical fault values. As new fault studies are made, the old bus fault cards are replaced.

When ungrounded wye or delta-connected capacitors are operated without case grounds, the low-voltage control circuits of the oil switches are regularly subjected to high 60-cps voltages as a result of non-simultaneous operation of the switches. This overvoltage can be eliminated by grounding the capacitor cases, said D. C. Keezer, Pacific Gas & Electric Co. Operating experience on the PG&E 12-kv distribution system shows that capacitor switches with ungrounded tanks do not operate on three-wire circuits for more than a fraction of their expected life.

Unlike the 60-cps overvoltage, the 8-kv transient voltage that appears between the control leads and the grounded switch tanks for a few microseconds after the first switch closes cannot be eliminated by grounding the capacitor rack, said Keezer. But the transient can be reduced to about 2 kv by bonding the control lead neutral to the capacitor rack. Most modern switches withstand this impulse voltage, but the transient can be further reduced to about 500 v by connecting small capacitors between the control leads and rack. Bonding gives a margin of safety after the control circuit's original impulse level has been reduced by contamination or deterioration.

A new computer program minimizes the cost of station ground grids, said R. F. Stevens, BPA. Three interrelated factors are varied to establish a minimum safe grid design, burial depth, diameter, and spacing. In the past, various utilities used quite different standards. Most existing grids are adequate, but are often more costly than necessary, he said. Machine computation could bring substantial savings wherever the ground grid investment is large or grounding conditions adverse.

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3—1000 kva Standard, 1/44000/6900
3—1000 kva Standard, 1/69000/4160Y/2400
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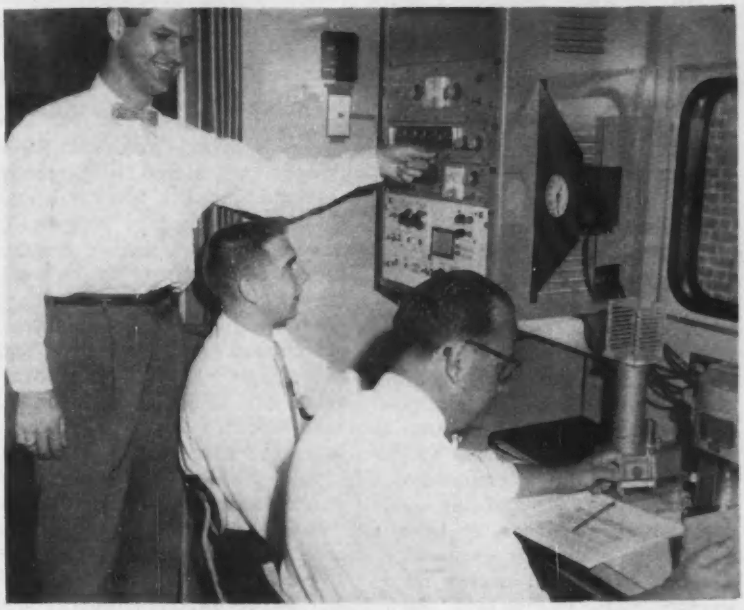
Two Radioisotope Courses Set

Three Connecticut utilities sponsor plan to teach industrial personnel techniques of using radioactive isotopes



HIGH-SPEED GAMMA-RAY COUNTER is demonstrated by lab technician. Student at right holds a radioactive test sample

Three Connecticut electric utilities are sponsoring two courses in radioisotopes for technical personnel of industries in their state. The second of the two-week courses, now being conducted at the United Illuminating Co at Bridgeport, is being attended by 11 men. The cooperating utility companies are Connecticut Light & Power Co and Hartford Electric Co. Dr Herbert M. Clark, professor of physical and nuclear chemistry at Rensselaer Polytechnic Institute, conducts the classes.

It became possible for the three companies to put on the courses when a mobile radioisotopes laboratory, until now restricted to instruction at colleges, was made available to them by the Oak Ridge Institute of Nuclear Studies. Each course comprises ten sessions in the mobile laboratory under the direction of Tom Stone, technician for the Institute of Nuclear Studies, ten lecture sessions conducted by Dr Clark, and five seminars by representatives of the Atomic Energy Commission, the State Department of Health, and industries making and using radioisotope equipment. The current course started Sept. 6. The first one, held at Berlin, headquarters for Connecticut Light & Power, began Aug. 22 and was attended by a capacity group of 12, three of them from the utility companies. The class is limited by the size of the laboratory, which accommodates six.

Gain Seen for Utilities

The aim of the courses is to teach industrial personnel the techniques of using radioactive istotopes and show how these materials can be exploited to improve industrial processes. Although the immediate objective is benefit for the industrial firms, most of them manufacturers, that have sent students to the courses, the utilities will be long-range gainers, too. Q. Q. Quinn, industrial sales manager of Connecticut Light & Power, pointed out that, by improving the competitive position of the state's industry, the utility companies are insuring their own industrial-load growth. A plant his company serves, by substituting continuous measurement with a radioisotope for a manual measurement, has already doubled the drive speed of one process, hence increased the energy that drive consumes.

Degrees Required

The cost of conducting the courses is being borne mostly by the three utilities. The enrollment fee, $100 for each student, covers but a part of the cost. Each enrollee was required to have a degree in science or engineering to be eligible. The students are given every other afternoon off to take care of business.

The courses were arranged through Arthur V. Peterson, Coordinator of Atomic Development Activities for the state of Connecticut. The three utilities cooperated last March in presenting a two-day radioisotopes workshop at Yale University attended by over 200.

Niagara Mohawk Seeks Rate Boost by Oct. 31

Niagara Mohawk Power Corp has submitted new electric rates to the New York State Public Service Commission and requested that they go into effect Oct. 31.

The new rates will mean an increase of under 1⅓¢ a day for a majority of the residential and farm customers throughout the company's upstate New York service area.

The proposed rate schedules, applying to over a million residential, farm, commercial, and industrial customers, represent an increase of about 6%. The new rates will increase Niagara Mohawk's annual electric revenues by an estimated $11.2 million before taxes.

Niagara Mohawk had announced last February, and again at its annual stockholders meeting in May, that following the completion of studies then pending, the company would seek an electric rate increase.

In filing the request with the PSC, the company asked that a public hearing be held as soon as possible.

Duke University Sets EE Graduate Program

An electrical engineering PhD program covering both electronics and 60-cycle power has been instituted by Duke University.

Initial dissertations are expected to be on "molecular electronics," an area felt to be fundamental to both electronics and 60-cycle power. Research is already underway on the fundamental properties of ferromagnetic materials and dielectric breakdown of insulating materials—both with possible application to electronics and 60-cycle power.

Research projects in 60-cps power will use the "energy-conversion" approach to the study of electric machinery. Feedback control systems and overall power system problems will also be emphasized.

Recognizing the growing need for electrical engineers to have a knowledge of nuclear engineering, Duke is offering an elective introductory course in that field. Additional nuclear engineering courses will be added as demand develops.

Chairman of the EE department is Dr C. R. Vail, formerly of General Electric Co's Power Division.

Suggests Alaskan Grid Plan Be Given to Candidates

Gus Norwood, Northwest Public Power Assn Executive Secretary, told an Alaska Rural Electric Co-op Assn meeting recently in Anchorage that a specific program for a "giant power" 500-kv transmission grid in Alaska should be given to both presidential candidates.

Norwood said the plan has been endorsed by NRECA General Manager Clyde Ellis, and calls for: **(1)** mass-produced "low cost" power at large generating stations, **(2)** an integrated 500-kv grid, **(3)** consumer-owned distribution lines, **(4)** rural electrification under the "area coverage" principle, **(5)** "low cost" investment funds on a self-liquidating basis, **(6)** progressive load forecasts, **(7)** creation of a statewide wholesale marketing body.

PG&E Contract Brings Project Near Realization

A contract for purchase of the use of water for power has been signed with Browns Valley Irrigation District by Pacific Gas & Electric Co, bringing the district's Virginia Ranch Reservoir Project a step closer to realization.

Water from the project will be used by PG&E in its Colgate and Narrows powerhouses. The utility's payment of up to $74,000 a year for 50 years will support financing of the project.

The payment will assure the district of income to meet payments on a proposed federal loan which has been approved by Interior Secretary Fred Seaton and the California Districts Securities Commission. District officials are confident the proposal will be endorsed by voters when it is submitted to them in a special election.

The $4.9-million Virginia Ranch Project includes a 147-ft-high dam with a 53,000-acre-ft reservoir.

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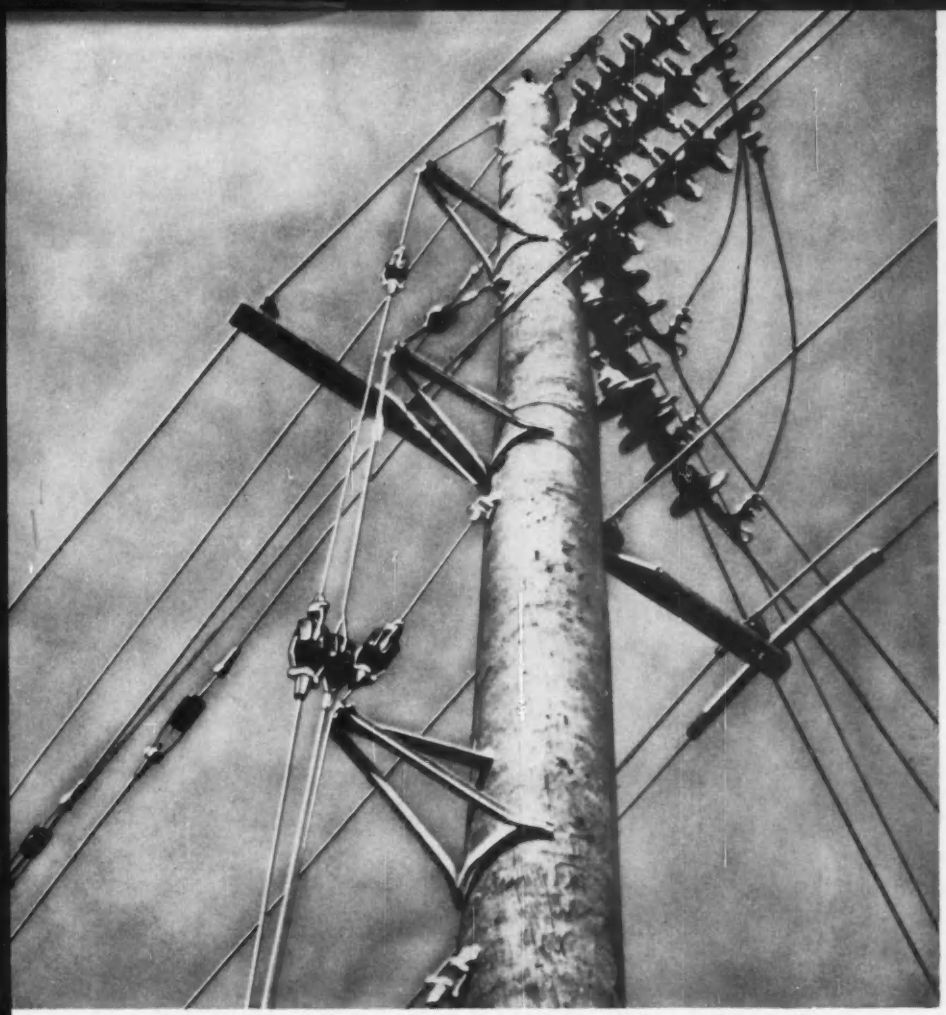

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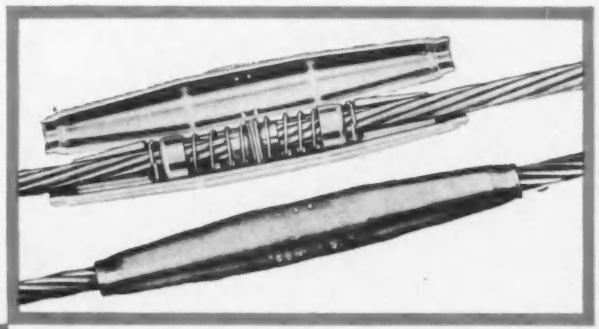

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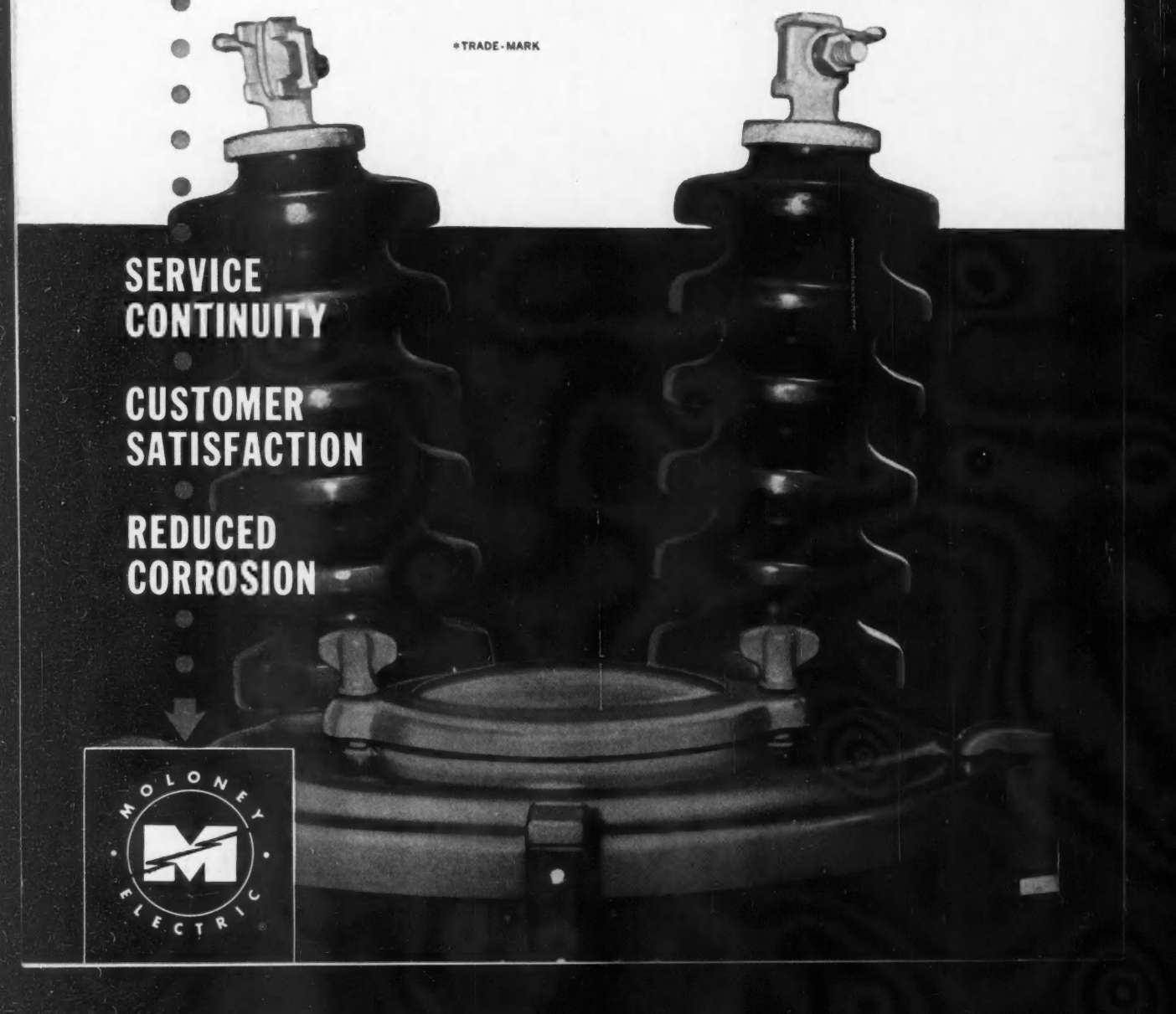
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